December, 1982 FHWA-MA-EIS-82-02-D

Draft Environmental Impact Statement/Report

Third Harbor Tunnel Project, Interstate 90

Boston, Massachusetts

A Cooperative Effort of

U.S. Department of Transportation
Federal Highway Administration

Massachusetts Department of Public Works
Massachusetts Turnpike Authority

FHWA-MA-EIS-82-02-D

INTERSTATE ROUTE 90, EXTENSION FROM INTERSTATE ROUTE 93 TO EAST BOSTON
THIRD HARBOR TUNNEL PROJECT

Draft
Environmental Impact Statement/Report
Submitted Pursuant to 42 U.S.C. 4332(2)(C)
and 49 U.S.C. 1653(f) by the
U.S. Department of Transportation
Federal Highway Administration
and
Massachusetts Department of Public Works
and
Massachusetts Turnpike Authority

Cooperating Agencies

U.S. Environmental Protection Agency
U.S. Army Corps of Engineer
U.S. Coast Guard
U.S. Department of the Interior
U.S. Department of Housing and Urban Development
Federal Aviation Administration
Amtrak
Conrail

Massachusetts Executive Office of Environmental Affairs
Massachusetts Department of Environmental Quality Engineering
Metropolitan Area Planning Council
Massachusetts Port Authority
Massachusetts Historical Commission

12/20/82
Date of Approval

for [signature] Robinson
Division Administrator
Federal Highway Administration

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This document examines the No-Build Alternative and four build alternatives for the Third Harbor Tunnel project, extending the Massachusetts Turnpike (I-90), a toll facility, from its present terminus at the Central Artery in Boston across Boston Harbor making new, direct connections to Logan International Airport and Route 1A in East Boston. Alternatives 2 and 4 utilize the Conrail railroad right-of-way in East Boston, while Alternatives 3 and 5 traverse a portion of Logan International Airport (landside). All build alternatives involve tunnel construction within and along the Fort Point Channel in Boston.

Send comments to the following individuals by MAR 21 1983 at the respective addresses listed above.

FHWA

Mr. Norman J. VanNess
Division Administrator

MDPW

Mr. Justin L. Radlo, P.E.
Chief Engineer

This document is also prepared in accordance with the Massachusetts Environmental Policy Act (MEPA), EOEA No. 4325.

A. DESCRIPTION OF THE PROPOSED ACTION

The proposed action will extend Interstate Route 90 (the Massachusetts Turnpike) from its present terminus at the Central Artery in Boston across Boston Harbor to a new terminus in East Boston. The project is located entirely in the City of Boston, Suffolk County, Massachusetts. The purpose of the Third Harbor Tunnel is to increase cross-harbor highway capacity above that of the existing Callahan and Sumner Tunnels and the Mystic-Tobin Bridge. The Third Harbor Tunnel will be a four-lane, limited access toll highway, approximately 3.3 to 3.8 miles in length and with optional improvements to the Central Artery, depending upon the specific alternative. The Tunnel will have direct connections to the Massachusetts Turnpike and Central Artery in Boston and to Logan Airport and Route 1A in East Boston.

B. OTHER SIGNIFICANT GOVERNMENT ACTIONS IN THE AREA

Other significant actions by Federal governmental agencies on the Boston side of the Harbor in the project area include the following:

1. Federal Highway Administration (FHWA)/Massachusetts Department of Public Works (MDPW) reconstruction of the Southeast Expressway/Central Artery south of the Massachusetts Turnpike interchange, including addition of a traffic management lane;

2. FHWA/MDPW Central Artery North Area Project, including reconstruction of the Interstate Route 93/U.S. Route 1 interchange;

3. FHWA/MDPW Central Artery Deck Reconstruction;

4. U.S. Urban Mass Transportation Administration (UMTA)/Massachusetts Bay Transportation Authority (MBTA) improvement projects in the South Cove/South Bay Area, including the South Station Transportation Center and the Wye Connector;

5. FHWA/MDPW/City of Boston Transportation Systems Management improvements in the Dewey Square Area.

6. Several related combined sewer overflow (CSO) treatment, collection, and outfall facility projects by the U.S. Environmental Protection Agency (EPA)/Metropolitan District Commission (MDC)/Boston Water and Sewer Commission (BWSC) in the South Bay, Fort Point Channel, and Waterfront areas;

7. FHWA/MDPW Northern Avenue Bridge Replacement Project.

Within Boston Harbor, other significant proposed actions include:

8. U.S. Coast Guard Special Anchorage Area at the mouth of Fort Point Channel;

9. U.S. Army Corps of Engineers maintenance dredging and possible deepening of the Boston Harbor Shipping Channel.

On the East Boston side of the harbor, other significant proposed Federal actions include:

10. Related EPA/MDC/BWSC Combined Sewer Overflow collection and treatment projects along the south waterfront and on Bird Island Flats at Logan Airport.

Other non-Federal projects in the area include the private Rowe's Wharf Development on a Fort Point Channel parcel owned by the Boston Redevelopment Authority (BRA); the East Boston Piers development being planned by the BRA and Massachusetts Port Authority (Massport); and the Massport Bird Island Flats air cargo and mixed use developments, including a public waterfront park at Logan International Airport.

C. MAJOR ALTERNATIVES CONSIDERED

A 1980 Corridor Planning Study for reconstruction of the Central Artery and construction of a Third Harbor Tunnel considered 13 highway alternatives and 11 transit options. At that time it was concluded that the demand for cross-harbor transportation service could not be adequately met solely by transit options, although such options could supplement the services provided by improved highway connections. From the 13 highway alternatives, 5 were recommended by the MDPW and approved by the FHWA for further detailed analysis; this EIS/EIR represents the next stage in the analysis of these alternatives. They are:

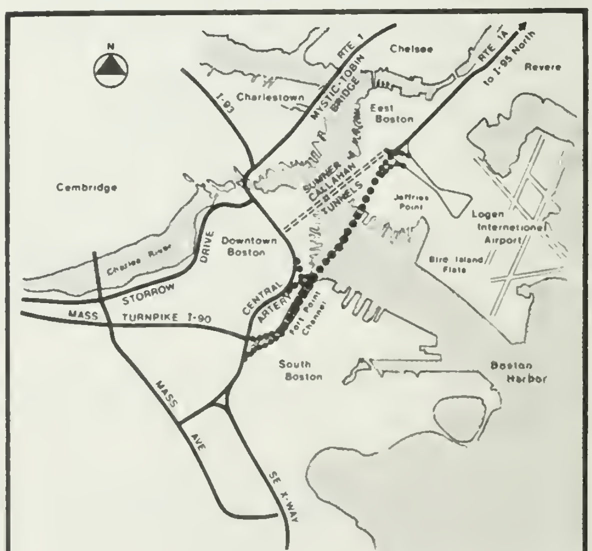
Alternative 1: No-Build

Alternative 1 involves no new construction of transportation facilities except for the separate projects described above in Section B. It is the base case against which the four build alternatives are compared in this EIS/EIR. Cross harbor access will be provided by the existing Callahan/Sumner Tunnels (30 cent toll each way) and Mystic Tobin Bridge (25 cent toll each way).

Alternative 2: Westerly Tunnel with Central Artery Improvements (Railroad Alignment)

Alternative 2 involves the construction of a one-way, five-lane northbound tunnel from the Massachusetts Turnpike/Central Artery interchange through Fort Point Channel. Near the mouth of the Channel, this one-way tunnel splits, with three toll-free lanes reconnecting to the Central Artery northbound and two lanes continuing across Boston Harbor to a new toll plaza in East Boston. The tunnel's two southbound lanes run next to the northbound lanes in a single structure from the East Boston Toll Plaza to the mouth of Fort Point Channel in Boston. They then split, connecting to the southbound Central Artery just before the existing Dewey Square Tunnel, which will become one-way southbound (six lanes). In East Boston, the tunnel will lie within the Conrail railroad right-of-way and industrial land next to Bremen Street, with an open toll plaza between Gove and Porter Streets. The tunnel will have connections to the Southeast Expressway, Central Artery, Massachusetts Turnpike and Frontage Road in South Boston (on ramp); Summer Street in Fort Point Channel (on ramp); and the main Logan Airport roadways and Route 1A in East Boston.

ALTERNATIVE 1



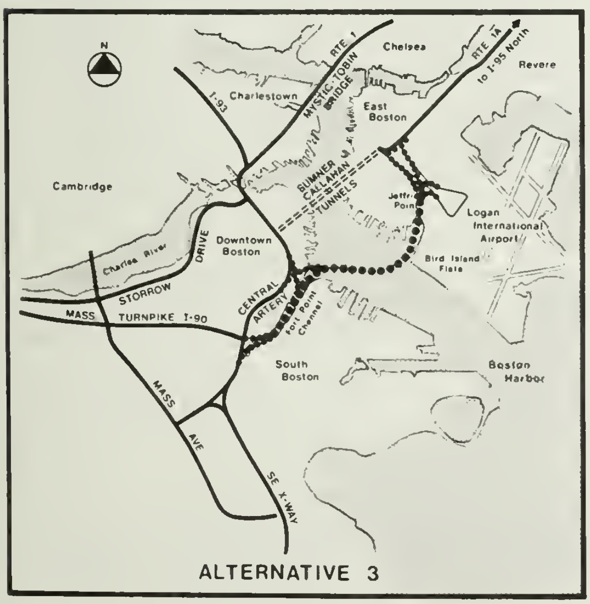
ALTERNATIVE 2

A new Dorchester Avenue will be constructed above the tunnel structure in Fort Point Channel, with connections to the Central Artery, Frontage Road, and cross streets.

The cost of Alternative 2, including construction and property acquisition, is estimated to be $749 million in 1982 prices. Tolls for the new and existing tunnels will be made uniform and are estimated to average 50 cents each way.

Alternative 3: Easterly Tunnel with Central Artery Improvements (Airport Alignment)

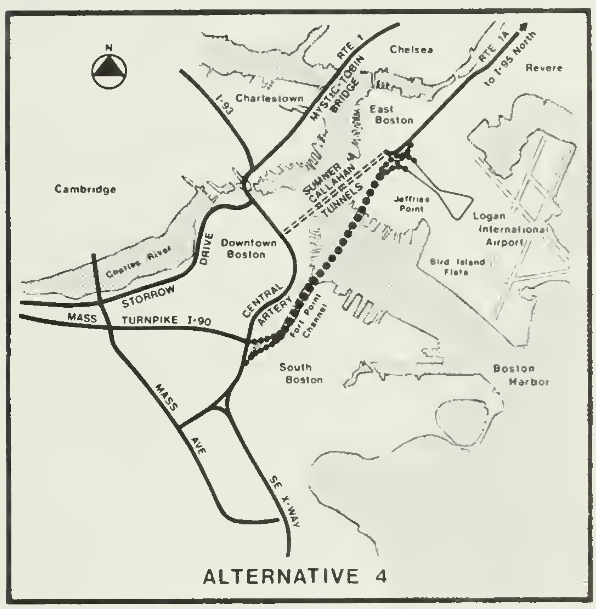
Alternative 3 on the Boston side consists of the same "split" alignment and improvements to the Central Artery as Alternative 2. However, the alignment follows a more easterly course under Boston Harbor; passes between Bird Island Flats and Jeffries Point, surfacing at Logan Airport with connections to the main Airport roadways; and terminates at Route 1A near the existing airport roadway ramps. The cost of Alternative 3, including construction and property acquisition, is estimated to be $945 million in 1982 prices. Tolls for the new and existing tunnels will be uniform and are estimated to average 55 cents each way.



ALTERNATIVE 3

Alternative 4: Westerly Tunnel without Central Artery Improvements (Railroad Alignment)

Alternative 4 involves the construction of a two-way four-lane tunnel from the Massachusetts Turnpike/Central Artery interchange in Boston through Fort Point Channel, across Boston Harbor and into East Boston along the same westerly "railroad" alignment as Alternative 2. There are no direct connections with the Central Artery north of the Massachusetts Turnpike interchange. Other connections are generally the same as those for Alternative 2, with additional off-ramps at Summer Street in Fort Point Channel and Albany Street in the South End. The cost of Alternative 4, including construction and property acquisition, is estimated to be $735 million in 1982 prices. Tolls for the new and existing tunnels will be uniform and are estimated to average 50 cents each way.

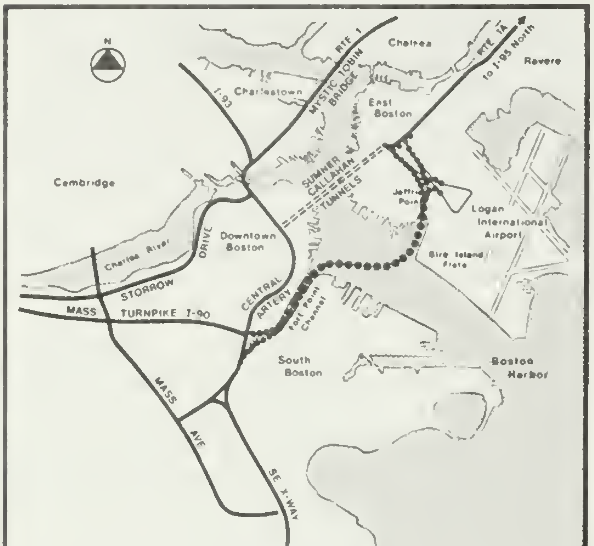


ALTERNATIVE 4

Alternative 5: Easterly Tunnel without Central Artery Improvements (Airport Alignment)

Alternative 5 on the Boston side consists of the same "two-way" alignment and connections as Alternative 4. It continues across Boston Harbor into Logan Airport along the same easterly alignment as Alternative 3. All connections in

East Boston are identical to those for Alternative 3. The cost of Alternative 5, including construction and property acquisition, is estimated to be $927 million in 1982 prices. Tolls for the new and existing tunnels will be made uniform and are estimated to average 55 cents each way.



ALTERNATIVE 5

GUIDE TO ALTERNATIVES

Alignment	Alternative 1	2	3	4	5
No-Build	X				
Boston "Split"		X	X		
"Two Way"				X	X
East Boston "Railroad"		X		X	
"Airport"			X		X

D. SUMMARY OF SIGNIFICANT BENEFICIAL AND ADVERSE IMPACTS

A summary of the major beneficial and adverse environmental impacts is given below. A matrix at the end of this Summary is also included for comparison of alternatives.

Traffic crossing Boston Harbor will increase approximately ten percent between 1982 and 2010 under the No-Build Alternative, to 170,000 vehicles on an average weekday. Traffic congestion and queuing will occur during several hours of the day on the Central Artery, the Mystic-Tobin Bridge, and in both existing tunnels. For the Callahan/Sumner Tunnels in particular, at-capacity or forced-flow conditions--and resulting delays, queues, and backups onto the Central Artery--will increase from five hours each commuting weekday in 1982 to 14 hours (generally from 6 AM to 8 PM) in 2010.

Traffic crossing the harbor in 2010 will be 10 to 11 percent higher than the No-Build under all build alternatives due to Logan Airport-induced trips and traffic diverted from other local crossings. Traffic will be diverted from the Mystic-Tobin Bridge and the existing tunnels to the proposed Third Harbor Tunnel, reducing the remaining traffic on these facilities to 70-75 percent of existing levels. Traffic congestion and queuing will be reduced in duration from 14 hours (in 2010) without a Third Harbor Tunnel to only one or two hours of the day, depending upon the alternative.

The traffic impacts on other roadways and local streets in South Boston, the South End, Downtown Boston, and East Boston are similar for all build alternatives. With the No-Build Alternative, traffic will increase on most major streets by 2010; with all build alternatives, traffic will be mostly unchanged or slightly lower than comparable No-Build volumes in 2010. On most local streets, traffic which previously attempted to short cut congestion on the expressway systems in Boston and East Boston will divert back to the express facilities because of improved traffic operations and more direct connections.

Other transportation improvements were evaluated independent of the proposed tunnel. Minor modifications of several of the

Central Artery ramps, though beneficial, will not improve traffic levels of service significantly, even when combined with the proposed tunnel. Extensive improvements to Blue Line service will have limited benefits for cross-harbor, airport, and Central Artery traffic; improved bus service will have lesser benefits. One-way toll collection at all tunnels and the Mystic-Tobin Bridge will have little effect on traffic distribution patterns as compared to the current method of two-way toll collection.

During construction, traffic will be alternately detoured on the West Fourth Street, Broadway, and other Fort Point Channel bridges under all build alternatives, as the bridges will be closed and reconstructed sequentially. Some temporary bridge structures will also be utilized (Congress Street and Summer Street). These alternate bridge closings and width restrictions will cause increased traffic on some local streets in South Boston and the South End. The new Northern Avenue Bridge will remain open at all times. Under all alternatives, Central Artery traffic flow will be maintained, but removal of the Northern Avenue on-ramp under Alternatives 2 and 3 will cause traffic diversions to Atlantic Avenue and Commercial Street. With Alternatives 2 and 4 in East Boston, the bridges crossing the railroad right-of-way will be also closed and reconstructed sequentially, but a temporary crossing will also be added and congestion will be minimal. Under Alternatives 3 and 5, airport service road traffic will be temporarily diverted.

Air quality impacts in the long term will be beneficial with the Third Harbor Tunnel project. Under the No-Build, there will be improvements in carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbon emissions due to planned federal automobile emission controls, but CO standards and NOx criteria will continue to be exceeded near the existing tunnel portals in the North End and East Boston. Under all build alternatives, concentrations of these pollutants will be reduced from those of the No-Build Alternative at these locations; these improvements are due to the significant reductions in traffic, delays, and queuing at the existing tunnel portals. There will be a net reduction in NOx concentrations at most locations.

Air quality will be affected during some periods of construction due to increased congestion at locations which are presently air quality "hot spots", such as Dewey Square, Broadway Station, Atlantic Avenue, and the existing East Boston toll plaza. Suspended particulates may also increase near the construction sites due to the construction activities.

Noise levels will increase perceptibly (by at least 3 decibels) between 1982 and 2010 under the No-Build Alternative at several sensitive receptor sites: Rotch Playground, St. Peter and Paul Church, the Boston Tea Party Museum, Bremen Street near Porter Street, and at East Boston Memorial Stadium. In 2010 under Alternative 2, perceptible noise level increases will occur at the Tea Party Museum and Frankfort Street residences in East Boston relative to the No-Build Alternative. Under Alternative 3, only the Boston Tea Party Museum will experience a perceptible noise level increase, while Alternative 4 will only cause a perceptible noise increase for Frankfort Street residences in East Boston. Alternative 5 will not cause perceptible increases at any sensitive receptor sites. Perceptible noise level decreases as compared to the No-Build Alternative in 2010 will occur under Alternatives 4 and 5 at St. Peter and Paul Church and Dockside Condominiums on Sleeper Street in South Boston. Alternatives 2 and 4 will cause a perceptible noise level decrease at Waterfront Park in Boston.

During construction of all build alternatives there will be substantial noise impacts (greater

than 15 decibels) at the Boston Tea Party Museum. Additionally, Alternative 2 will have substantial impacts on Bremen Street residences north and south of Porter Street and moderate impacts (10 to 15 decibels) on Harbor Towers. Alternative 3 will have moderate impacts on Harbor Towers and East Boston Stadium. Alternative 4 will have substantial impacts on Bremen Street residences south of Porter Street and moderate impacts on Rotch Playground. Alternative 5 will have moderate noise impacts on Rotch Playground.

There will be no long-term operational impacts due to vibration on the Red Line or Blue Line tunnels or other public and private facilities under any of the build alternatives.

Construction vibration-induced structural damage will affect only one building (Hook Lobster) in the project area, adjacent to Fort Point Channel under Alternatives 2 and 3. All build alternatives have potential for causing minor architectural damage due to construction vibration at selected structures within the Fort Point Channel Historic District. Alternatives 4 and 5 have potential for causing minor architectural damage to several historic structures in the Albany Street area. Temporary annoyance due to vibration will exist in several neighborhoods under all alternatives. No vibration-induced structural damage will occur to the Red Line or Blue Line tunnels.

Land use impacts will be both beneficial and adverse, depending on location. All build alternatives will have small beneficial impacts on the value of industrial and commercial property in the South End; property in the Fort Point Channel area generally; and developable land at Logan Airport. There will be localized adverse impacts on properties adjacent to proposed ramps and ventilation buildings in the Fort Point Channel area and adjacent to the proposed toll plaza in East Boston with Alternatives 2 and 4. Logan Airport will lose leasable land with Alternatives 3 and 5.

Community impacts will be neglible or somewhat positive in the long term due to reduced local traffic at most locations for all alternatives. In East Boston there will be general improvement in the quality of life due to improved air quality and reduced congestion on several local streets under all build alternatives, but adverse impacts on community cohesion and quality of life could result in localized areas near the proposed toll plaza under Alternatives 2 and 4. The new tunnel will improve cross-harbor emergency vehicle access due to reduced congestion and the presence of an alternative route. Access to community facilities will not be adversely affected.

Construction period community impacts (quality of life, access, etc.) will occur in portions of South Boston due to increased traffic in the Andrew Square and Broadway/Dorchester Avenue intersections and on D Street near the Condon School. Significant community quality of life impacts will result from temporary air quality and noise impacts in East Boston under Alternatives 2 and 4; pedestrian and vehicular access to community facilities will be maintained.

Relocations of residences will not occur under any alternative. There will be 16 business relocations under Alternative 2, 24 relocations with Alternative 3, 14 relocations with Alternative 4, and 22 relocations with Alternative 5. Relocations on the airport under Alternatives 3 and 5 will be costly to some businesses, particularly Eastern Airlines; several East Boston businesses displaced by Alternatives 2 and 4 will be difficult to relocate.

Economic impacts include land use and relocation impacts described above. The net impact will be somewhat positive on property values and City of Boston tax revenues. In Alternative 2 and 4 up to 100 jobs held by East Boston residents may be affected by business relocations, and several local businesses serving the relocated firms may potentially lose

revenue.

Construction period impacts include the creation of approximately 5000 person years of employment at the construction site and from 13,000 to 17,000 person-years of employment off-site. Direct labor expenditures will range from $224,000,000 to $281,000,000, depending on the build alternative. Some temporary business losses will occur owing to relocation and disrupted access, and City of Boston tax revenues will be reduced temporarily. Business losses will be greater under Alternatives 3 and 5, while tax losses will be greatest under Alternative 2. Development will likely be delayed on Rowe's Wharf and potentially delayed on other sites near the Fort Point Channel.

Historic impacts will occur in the Fort Point Channel potential National Register District, and will involve reduced water area, alterations to historic bridges and bulkheads, and introduction of new structures within the Channel. Russia Wharf and South Station will be indirectly affected. Under Alternatives 2 and 3, the removal of the High Street ramp will benefit the Custom House Historic District.

Construction period impacts will result from noise and dirt at Russia Wharf and the Fort Point Channel (all alternatives) and the Custom House District (Alternatives 2 and 3).

Visual impacts will occur in the Fort Point Channel for all build alternatives due to the reduction of the Channel's water surface, changes in the symmetry of existing bridges, addition of a ventilation building and elevated ramp(s). With Alternatives 2 and 4 in East Boston, grass-covered open space will replace part of the existing railroad cut, but a visual (wall) barrier will be created between neighborhoods on opposite sides of the right-of-way; visually the proposed toll plaza and ventilation building will adversely affect nearby residential blocks. With Alternatives 3 and 5, no adverse aesthetic impacts will occur in East Boston.

Wetlands, water quality, wildlife, and vegetation impacts will be negligible, except at the sunken tube fabrication site in Lynn, Massachusetts, where there will be a three year disturbance to 75 acres of shallow water intertidal habitat including 21 acres of blue mussel flats. Upon completion of the tunnel tube fabrication, the site will then be restored; the shellfish habitat will be naturally re-established over a period of time.

Water Quality impacts due to dredging and disposal of dredged materials will be minor. Based on the detailed sediment analyses, Third Harbor Tunnel dredge sediments meet applicable standards for disposal at the Massachusetts Bay Foul Area.

Section 4(f) involvement includes takings of small amounts of land under all build alternatives at East Boston Memorial Stadium. The extent of takings is larger for Alternatives 3 and 5. There will be an overall improvement in air quality at the stadium with all alternatives. If the proposed Bird Island Flats Park has been completed prior to the tunnel construction, a portion of this park will be disrupted during construction of Alternatives 3 and 5, and then returned to its original condition.

Section 4(f) involvement also includes impacts to the Fort Point Channel potential National Register Historic District as described previously.

Utilities will be temporarily or permanently relocated during construction, and they neither pose significant problems nor will they be significantly affected by any of the build alternatives.

Energy impacts are approximately one percent higher for all build alternatives when compared to the No-Build Alternative in terms of total energy consumption (vehicle

operations, facility construction, facility maintenance, etc.).

E. ISSUES/AREAS OF CONTROVERSY

Issues and areas of controversy identified during the course of the study, including those raised by agencies and the public, are listed below. All technical issues are addressed in this document.

- o Consideration of improvements to mass transportation facilities as alternatives to a Third Harbor Tunnel.
- o Consideration of improvements to the Central Artery, especially to the approaches to the existing Callahan/Sumner Tunnels, as alternatives to a Third Harbor Tunnel.
- o Alternative toll collection practices (i.e., one-way tolls) and location of toll plazas.
- o State and local public officials, local community groups (especially in East Boston), and environmental groups opposition to a Third Harbor Tunnel.
- o Induced traffic potential of a Third Harbor Tunnel.
- o Intrusions of regional highway traffic into South Boston, South End, and East Boston neighborhoods.
- o Sensitivity of Red Line and Blue Line Tunnels to Third Harbor Tunnel construction vibration.
- o Fear of residential property taking; (none will occur).
- o Locations of ventilation buildings.
- o Locations of Fort Point Channel ramps to Third Harbor Tunnel.
- o Albany Street ramp location and configuration.
- o Sensitivity of the Gillette Company to Third Harbor Tunnel construction vibration and reduction of Fort Point Channel industrial cooling capacity.
- o Open water disposal of contaminated harbor sediments.
- o Proposed dredging program and impacts to water quality (turbidity) and aquatic life.
- o Third Harbor Tunnel effects on quality/use of Fort Point Channel.
- o Impacts on East Boston Memorial Stadium recreation land.

F. SIGNIFICANT UNRESOLVED ISSUES

The following issues are unresolvable until the project, if approved, enters subsequent phases of project development.

- o The extent of Federal Interstate construction funding participation in the project and also in project landscaping and urban design features.
- o Massachusetts State Legislative passage of enabling legislation for Massachusetts Turnpike Authority (MTA) to sell bonds to assume state's 10 percent share of project construction-related costs, and to permit MTA to construct and operate a Third Harbor Tunnel toll facility.
- o Selection of the materials for sunken tube tunnel construction (concrete or steel).
- o Federal, State, and local permit approval of tube fabrication site.
- o Approvals of all required Federal, State, and local permits necessary for project to proceed.
- o Identification of appropriate staging areas for construction.

G. OTHER FEDERAL ACTIONS REQUIRED BECAUSE OF PROPOSED ACTION

- o Section 106 (National Historic Preservation Act of 1966) Memorandum

of Agreement - Advisory Council on Historic Preservation, if necessary.

o Sections 9, 10 and 11 permits (construction and dredging in navigable waters -- Boston Harbor and Lynn Harbor) - U.S. Army Corps of Engineers.

o Section 103 Permit (Marine Protection, Research and Sanctuaries Act) - U.S. Army Corps of Engineers.

o Section 404 Permit (wetlands and dredge spoils disposal) - U.S. Army Corps of Engineers.

o Section 401 Water Quality Certification (U.S. Clean Water Act) - Administered by the Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control.

o Federal Aviation Regulations, Parts 77, 151, 152 - Federal Aviation Administration.

o Construction agreements for railroad relocation - Amtrak and Conrail.

o U.S. Coast Guard approval for work in Boston Harbor.

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS
OF THIRD HARBOR TUNNEL ALTERNATIVES

IMPACT	ALTERNATIVE 1 No-Build		2 Split/RR		3 Split/Airp.		4 2-Way/RR		5 2-Way/Airp.	
TRANSPORTATION										
2010 Traffic Diversions relative to Alt. 1 (AWDT)										
o Callahan/Sumner Tunnels	0		-33,200	(-36%)	-32,200	(-35%)	-33,400	(-36%)	-31,200	(-34%)
o Mystic-Tobin Bridge	0		-25,600	(-32%)	-23,700	(-30%)	-25,200	(-32%)	-23,600	(-30%)
o Central Artery South of Callahan/Sumner Tunnels	0		-29,900	(-17%)	-28,800	(-17%)	-27,400	(-16%)	-27,200	(-16%)
o Mass. Turnpike Extension	0		+13,200	(+17%)	+12,800	(+16%)	+16,200	(+20%)	+15,600	(+20%)
o Route 1A, North of Airport	0		+15,600	(+39%)	+11,500	(+29%)	+15,600	(+39%)	+11,500	(+29%)
2010 PM Level of Service (# Locations)										
Existing Highway Sections	#	%	#	%	#	%	#	%	#	%
o A-D	19	(40)	21	(48)	19	(44)	25	(49)	22	(44)
o E	4	(8)	6	(13)	6	(14)	5	(10)	7	(14)
o F	25	(52)	17	(39)	18	(42)	21	(41)	21	(42)
TOTAL	48	(100)	44	(100)	43	(100)	51	(100)	50	(100)
South Boston Intersections										
o A-D	7	(50)	8	(53)	8	(53)	9	(60)	9	(60)
o E	1	(7)	1	(7)	1	(7)	0	(0)	0	(0)
o F	6	(43)	6	(40)	6	(40)	6	(40)	6	(40)
TOTAL	14	(100)	15	(100)	15	(100)	15	(100)	15	(100)
East Boston/Revere Intersections										
o A-D	10	(63)	13	(81)	13	(81)	13	(81)	13	(81)
o E	3	(18)	1	(6)	1	(6)	1	(6)	1	(6)
o F	3	(19)	2	(13)	2	(13)	2	(13)	2	(13)
TOTAL	16	(100)	16	(100)	16	(100)	16	(100)	16	(100)
Downtown Boston Intersections										
o A-D	2	(22)	4	(40)	3	(30)	4	(36)	5	(46)
o E	1	(11)	0	(0)	0	(0)	2	(18)	2	(18)
o F	6	(67)	6	(60)	7	(70)	5	(46)	4	(36)
TOTAL	9	(100)	10	(100)	10	(100)	11	(100)	11	(100)
Project Roadways and Approaches										
A-D	--	--	20	(67)	24	(73)	20	(80)	25	(89)
E	--	--	4	(13)	3	(9)	5	(20)	2	(7)
F	--	--	6	(20)	6	(18)	0	(0)	1	(4)
TOTAL	--	--	30	(100)	33	(100)	25	(100)	28	(100)
# Hours Callahan/Sumner Tunnels @ Level of Service E or F each Weekday: 2010	14		1		2		1		2	

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS
OF THIRD HARBOR TUNNEL ALTERNATIVES (Cont.)

IMPACT	ALTERNATIVE				
	1 No-Build	2 Split/RR	3 Split/Airp.	4 2-Way/RR	5 2-Way/Airp.
2010 Induced Traffic (veh. per day)	0	12,800	12,800	12,800	12,800
1987-1990 Construction Traffic Impacts (Affected Area)	None	Central Artery Financial Dist. North End Ft. Pt. Channel Bridges So. Boston- Andrew Square, B'Way/Dorch. Ave. So. End- Herald/Albany	Central Artery Financial Dist. North End Ft. Pt. Channel Bridges So. Boston- Andrew Square, B'way/Dorch. Ave. So. End- Herald/Albany Logan Airport Roads	Central Artery Ft. Pt. Channel Bridges So. Boston- Andrew Square, B'way/Dorch. Ave. So. End- Herald/Albany	Central Artery Ft. Pt. Channel Bridges So. Boston- Andrew Square, B'way/Dorch. Ave. So. End- Herald/Albany Logan Airport Roads
2010 Yearly Accident Reduction: Selected Loc.'s (% change vs. Alt. 1)	0	-11%	-21%	-12%	-17%
LAND USE					
Improved Access Incentives to Development (by area)	None	South End Ind. Area Ft. Pt. Channel So. Bos. Ind. Area Logan Airport	South End Ind. Area Ft. Pt. Channel So. Bos. Ind. Area Logan Airport	South End Ind. Area Ft. Pt. Channel So. Bos. Ind. Area Logan Airport	South End Ind. Area Ft. Pt. Channel So. Bos. Ind. Area Logan Airport
Reduced Development Potential (by area)	None	Some Ft. Pt. Channel sites E. Bos. Waterfront	Some Ft. Pt. Channel sites	Some Ft. Pt. Channel sites E. Bos. Waterfront	Some Ft. Pt. Channel sites
Residential Displacements/Relocations	None	None	None	None	None

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS
OF THIRD HARBOR TUNNEL ALTERNATIVES, CONT.

IMPACT	ALTERNATIVE				
	1 No-Build	2 Split/RR	3 Split/Airp.	4 2-Way/RR	5 2-Way/Airp.
Business Displacements/Relocations					
Boston: # Businesses	0	2	2	0	0
# Employees	0	75	75	0	0
East Boston: # Businesses	0	14	22	14	22
# Employees	0	160	435	170	435
Total: # Businesses	0	16	24	14	22
# Employees	0	245	510	170	435
ECONOMICS					
Project Cost ($ Million)					
Construction	0	730	919	731	915
Right-of-Way	0	19	26	4	12
Total	0	749	945	735	927
Construction Employment (Person-Years)					
On-site (Boston residents in parenth.)	0	4,800 (1,150)	5,100 (1,220)	4,100 (980)	5,100 (1,220)
Off-site (Mass. residents in parenth.)	0	16,000 (690)	17,000 (730)	13,200 (510)	16,500 (725)
Total	0	20,800	22,100	17,300	21,600
Construction-Period Economic Losses (by area)	None	Ft. Pt. Channel So. Bos. Ind. Areas	Ft. Pt. Channel So. Bos. Ind. Areas Logan Airport	Ft. Pt. Channel So. Bos. Ind. Areas	Ft. Pt. Channel So. Bos. Ind. Areas Logan Airport
Construction Period Tax Losses: City of Boston (per year)	None	$170,000	$125,000	$110,000	$70,000
Long-Term Tax Increases over No-Build: City of Boston (per year) (based on 1982 assessments and tax rate)	Base Case	$800,000	$800,000	$800,000	$800,000

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS
OF THIRD HARBOR TUNNEL ALTERNATIVES (Cont.)

IMPACT	ALTERNATIVE 1 No-Build	2 Split/RR	3 Split/Airp.	4 2-Way/RR	5 2-Way/Airp.
COMMUNITY FACILITIES					
Construction Period Neighborhood Disruption (by area)	None	East Boston So. Bos.-Dorch. Ave. No. End/Waterfront	So. Bos.-Dorch. Ave. No. End/Waterfront	East Boston So. Bos.-Dorch. Ave.	So. Bos.-Dorch.
Long Term Improvement in Neighborhood Quality of Life (by area)	None	South Boston Chinatown North End East Boston	South Boston Chinatown North End East Boston	South Boston Chinatown North End East Boston	South Boston Chinatown North End East Boston
Long Term Reduction in Neighborhood Quality of Life		East Boston - near project		East Boston - near project	
Cultural Historic (National Register) Properties	None	Ft. Pt. Channel Dist. (adverse) Custom House Dist. (beneficial)	Ft. Pt. Channel Dist. (adverse) Custom House Dist. (beneficial)	Ft. Pt. Channel Dist. (adverse)	Ft. Pt. Channel Dist. (adverse)
Parklands	None	E. Bos. Mem. Stadium	E. Bos. Mem. Stadium BIF Park (proposed)	E. Bos. Mem. Stadium	E. Bos. Mem. Stadium BIF Park (proposed)
AIR QUALITY (year 2010)					
Violations of 8-hr. CO standards (# locations)	4	0	0	0	0
Toll Plaza Contributions - 8 hr. CO (parts per million)					
Bremen at Gove	4.7	0.2	<0.2	0.2	<0.2
Porzio Park	1.1	<0.2	0.4	<0.2	0.4
Near Callahan Tunnel	8.0	0.3	0.3	0.3	0.3
Toll Plaza Contribution - 1 hr. NO_2 (ug/m^3)					
Bremen at Gove	359	22	12	22	12
Porzio Park	57	<10	22	<10	22
Near Callahan Tunnel	486	19	13	19	13

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS
OF THIRD HARBOR TUNNEL ALTERNATIVES (Cont.)

IMPACT	ALTERNATIVE 1 No-Build	2 Split/RR	3 Split/Airp.	4 2-Way/RR	5 2-Way/Airp.
NOISE					
Short-Term/Construction Noise: Substantial Impacts	None	1 Public Bldg. 1 Resid. St.	1 Public Bldg.	1 Public Bldg. 1 Resid. St.	1 Public Bldg.
Long-Term Noise Impact due to Project Streets in excess of FHWA Noise Abatement Criteria	N.A.	1 Playground 1 Public Bldg. 2 Resid. Streets	Playground 1 Public Bldg. 2 Resid. Streets	1 Playground 1 Public Bldg. Resid. Streets	1 Playground 1 Public Bldg.
VIBRATION					
Short-Term/Construction Impacts					
o Vibration Annoyance (# residents)	0	3100	460	3030	390
o Structural Damage Potential (# bldgs.)	0	1	1	0	0
Long-Term Impacts	None	None	None	None	None
WETLANDS, FLOODPLAIN, WATER RESOURCES WILDLIFE/VEGETATION IMPACTS	None	See below	See below	See below	See below
UTILITIES IMPACTS	None	None	None	None	None
VISUAL IMPACTS Long-Term	None	Fort Pt. Channel (neg.) E. Bos. R.R. r.o.w. (neg.)	Fort Pt. Channel (neg.) Jeffries Cove (pos.)	Fort Pt. Channel (neg.) E. Bos. R.R. r.o.w. (neg.)	Fort Pt. Channel (neg.) Jeffries Cove (pos.)
ENERGY IMPACTS	None	None	None	None	None
FABRICATION SITE IMPACTS PREFERRED LYNN FABRICATION SITE (CONCRETE TUBE)	None	Shallow water inter-tidal habitat disrupted	Shallow water inter-tidal habitat disrupted	Shallow water inter-tidal habitat disrupted	Shallow water inter-tidal habitat disrupted

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1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION OF THE PROJECT AREA

The project area has been generally defined to include an area large enough to encompass all subareas that may be affected by the proposed Third Harbor Tunnel project. It is approximately six miles long and three miles wide. (The traffic network described in Section 3.1.1 includes some links outside this area for which traffic characteristics are expected to change.)

The project area extends from the existing Fitzgerald, or "Southeast," Expressway between and including portions of the South End and South Boston across Boston Harbor into and through East Boston, to Bell Circle in Revere (see Figure 1). Major features of the project area are the following:

Highways: The Southeast Expressway and Central Artery (I-93) run north/south, intersecting the Massachusetts Turnpike (I-90) south of downtown Boston. The existing Callahan Tunnel (eastbound) and Sumner Tunnel (westbound) lie under Boston Harbor and connect the Central Artery with the East Boston Expressway (State Route 1A). Route I-93 continues north across the Charles River and interchanges with U.S Route 1, which diverges towards the northeast, crossing the Mystic River on the Mystic-Tobin Bridge. I-93 continues in a northerly direction through Massachusetts and into New Hampshire.

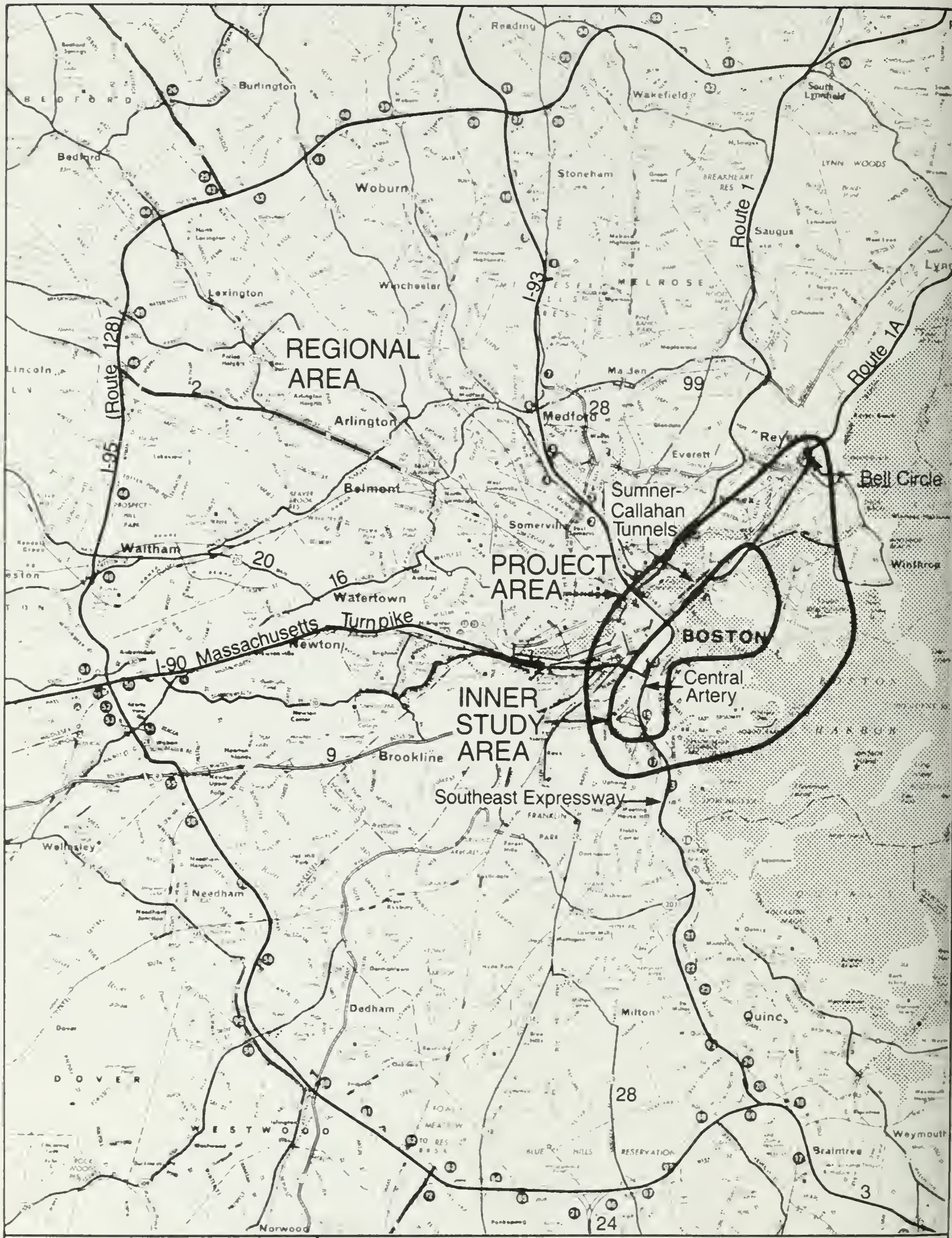
Other Transportation Nodes: South Station is located near the intersection of I-90 and I-93, in the Fort Point Channel area of Boston. It is a major rail terminus for Amtrak, commuter rail and intercity buses. Logan International Airport in East Boston has direct connections to the Callahan/Sumner Tunnels. It is the 13th busiest airport in the world in terms of passenger movements and is the major air cargo terminal for southeastern New England. Major marine cargo shipping terminals are located in South Boston; piers in East Boston are no longer used for this purpose.

Water Bodies: The Charles and Mystic Rivers join to form Boston Harbor, which has a major shipping channel serving the port's marine, commercial, industrial and military users; it is also used heavily by pleasure boats. Fort Point Channel, which is approximately 1 1/4 miles long and of varying width (approximately 400 feet wide at its midpoint), empties into Boston Harbor north of the Northern Avenue bridge. The Harbor and Channel are almost entirely bordered by piers and bulkheads that have been constructed at the edges of filled land.

Major Land Areas: The project area on the south side of the Harbor is situated in an industrial area between the residential neighborhoods of South Boston and the South End. South Boston is connected to the Southeast Expressway, the Central Artery, and Boston by a series of bridges over railroad land and Fort Point Channel. The northern half of South Boston is industrial and contains several major port facilities.

The Boston side of Fort Point Channel includes Chinatown-South Cove, which is residential and institutional in character; the South Station and Leather District area, which contains transportation and industrial uses; the Boston Financial District; and the Waterfront, which is residential and commercial.

The project area on the north side of the Harbor lies in East Boston, a dense residential neighborhood with vacant (underutilized) land along much of its waterfront and a railroad (presently unused) and highway corridor running north/south through it to the City of Revere. The project area includes part of Logan International Airport which occupies approximately 2000



Major Roadways
Project Area Boundary
Inner Study Area Boundary

Figure 1
Project Vicinity Map

0 3 6 Miles

EIS/EIR for I-90, The Third Harbor Tunnel

acres in East Boston.

1.2 PURPOSE AND NEED FOR ACTION

The Central Artery is the spine of the present system of express highways in the central area of Boston. Its southerly terminus is the Southeast Expressway at the Massachusetts Avenue interchange, and its northerly terminus is at the junction of Interstate Route 93 and the Mystic-Tobin Bridge (Route 1). Connecting to the Central Artery are two other key regional expressways, the Massachusetts Turnpike (Interstate 90) Extension and Storrow Drive; and two parallel tunnels under Boston Harbor joining downtown Boston and East Boston, the Sumner and Callahan Tunnels (see Figure 2).

The Sumner Tunnel was opened to traffic in 1934 to serve the growing demands for direct vehicular cross-harbor traffic movements between downtown Boston and East Boston which were previously served by ferry. East Boston was growing both residentially and industrially at that time; development included an airfield that would later become the thirteenth busiest airport in the world -- Logan International Airport.

Total demand for vehicular harbor crossings continued to increase during the 1930's and 1940's as a result of metropolitan area economic growth and the increased mobility requirements of the population. The Mystic-Tobin Bridge was subsequently constructed and opened in 1950 between Charlestown and Chelsea to accommodate this demand. With the Mystic-Tobin Bridge's opening and the population's trend toward suburbanization, total harbor crossings doubled by the early 1950's. With the openings of the East Boston Expressway (Route 1A) to Bennington Street in East Boston and the Central Artery from the Mystic-Tobin Bridge to Dock Square in Boston by the mid-1950's, the capacity of the Sumner Tunnel was reached and exceeded while harbor crossings continued to increase on the Mystic-Tobin Bridge.

By 1957, the Massachusetts Department of Public Works (MDPW) recommended construction of a second harbor tunnel in response to these travel demands, and had forecast the eventual need for a Third Harbor Tunnel to accommodate future growth of vehicular traffic in the Boston Metropolitan Area. This forecast proved true; the Callahan Tunnel opened in 1962, doubling the practical capacity of the Callahan/Sumner Tunnels pair. By the early 1970's, influenced by the resurgence of business activity in the downtown area due to both massive public and private capital investments (i.e., urban renewal), the dramatic growth in air travel at Logan Airport, and the opening of the Massachusetts Turnpike Extension in 1965 and Interstate Route 93 in 1972, the capacities of both tunnels and the Mystic-Tobin Bridge were being approached.

Today the Sumner Tunnel (inbound to Boston) operates at or above its practical capacity for three hours in the morning (7-10 AM) and two hours in the afternoon (3-4 PM and 6-7 PM) each weekday. The Callahan Tunnel (outbound from Boston) operates at or above its capacity for five hours in the afternoon (1-6 PM) each weekday. The resulting congestion causes considerable delays and queuing at both the Boston and East Boston approaches to the two tunnels, hampers the passage of emergency (fire, police, ambulance) vehicles across the Harbor, causes backups on the Central Artery, and encourages through traffic to attempt to short-cut the congestion on the expressway ramps to the tunnels by utilizing local residential streets in East Boston and the North End. The Mystic-Tobin Bridge also suffers from capacity deficiencies, queuing, and congestion for several hours each day, although to a much lesser extent than the Callahan/Sumner Tunnels. This Boston area traffic congestion, especially during peak commuter periods, attests to the present need for highway transportation improvements which provide relief for such congestion.

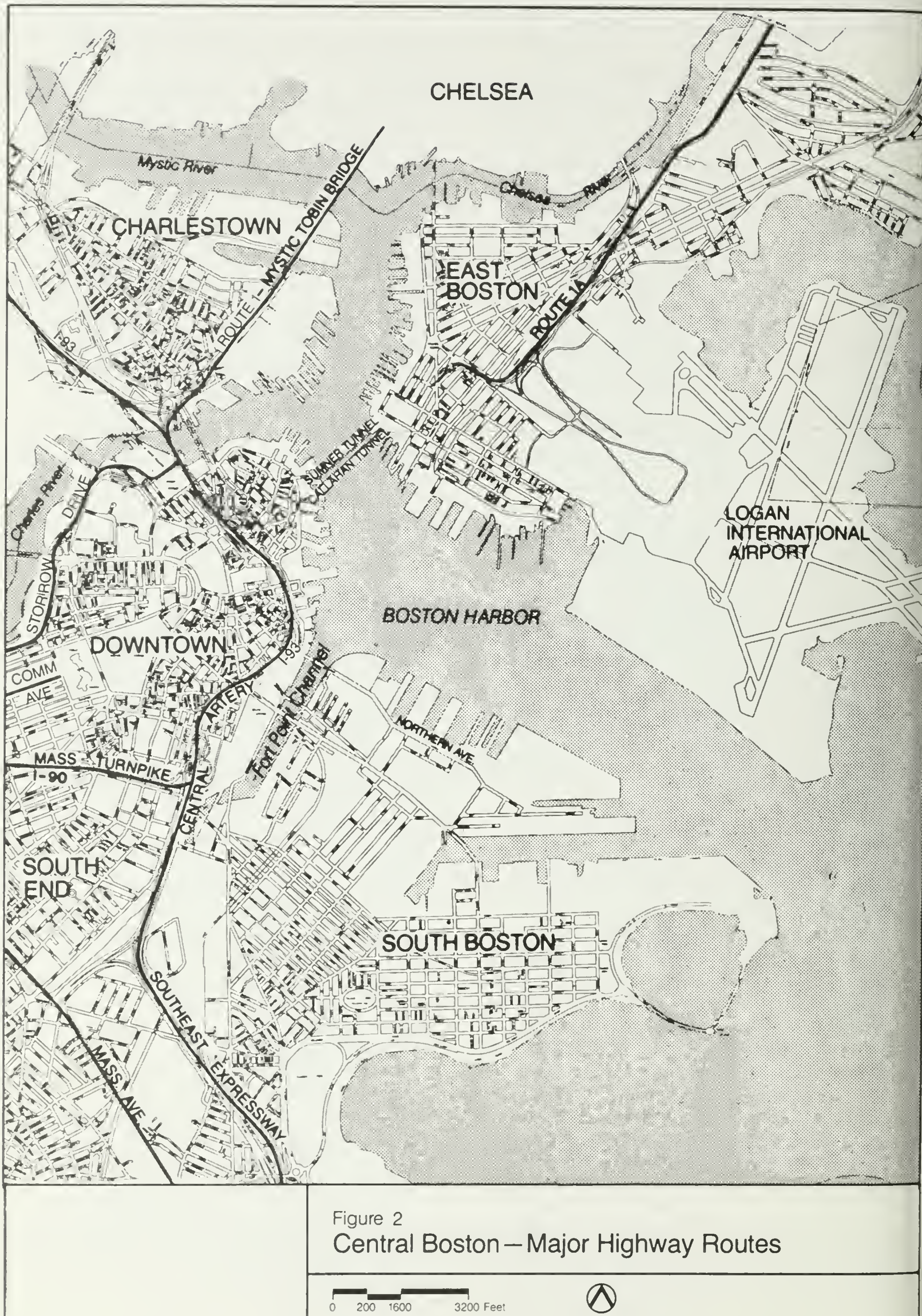


Figure 2
Central Boston – Major Highway Routes

EIS/EIR for I-90, The Third Harbor Tunnel

Traffic on Boston's regional highway network is expected to increase by 13 percent by 2010 due to continued regional economic growth; traffic growth at Logan International Airport attributable to increased air travel and airport-related development is expected to increase more dramatically, by 48 percent on the Airport access/egress roadways. While congestion on the Mystic-Tobin Bridge will be relieved somewhat by the MDPW's Central Artery North Area Project in Charlestown, this traffic growth will impose demands on the existing tunnels far in excess of their practical capacities, by as much as 50 percent during the peak hours, by 2010. Severe congestion and queuing will occur as a result of ator above-capacity operations within both tunnels and their approaches for up to 14 hours each weekday, or from 6 AM to 8 PM. Back-ups will extend well onto the Central Artery during the AM and PM peak hours in both directions on all approaches to the Callahan Tunnel, impeding traffic movements on that north-south expressway. In addition to back ups due to the Charlestown High-Level Bridge (northbound) back to the East Berkeley Street on-ramp, queues will also increase at the Northern Avenue on-ramp merge, the Callahan Tunnel exit, and the East Berkeley Street on-ramp merge. Southbound, queues will increase at the Haymarket on-ramp and the Callahan Tunnel off-ramp. This traffic congestion will be intolerable to travelers, residents, and businesses on both sides of the Harbor, further reinforcing the need for improvements in cross-harbor circulation and capacity which will reduce such congestion. (These conditions are caused by both heavy traffic volumes and geometric constrictions on the existing highway facilities and are discussed in greater detail in Sections 3.1 and 4.2 of this report.)

Furthermore, both existing and projected future traffic demand on the Central Artery, of which harbor crossing traffic is a major part, is more than twice the capacity for which that expressway was intended to serve. Designed to accommodate approximately 75,000 vehicles per day, some sections of the Central Artery currently carry in excess of 150,000 vehicles per day. The need to relieve this congestion is necessary not only for the harbor crossings, but also for the Central Artery itself, if the metropolitan Boston area's highway network is expected to adequately serve the travel demands brought about by increased economic growth and development in the City and the metropolitan region.

The purpose of the proposed Third Harbor Tunnel project is to provide needed additional vehicular Harbor crossing capacity in Boston; as such it will more than double vehicular crossing capacity. Together with the existing three harbor crossings -- the Callahan/Sumner Tunnels and the Mystic-Tobin Bridge -- vehicular harbor crossing travel demands will be served through 2010.

The Third Harbor Tunnel will have a beneficial rerouting, or diversionary effect on the existing Callahan/Sumner Tunnels, reducing potential 2010 traffic on them by approximately 35 percent (from 91,000 to 58,000-60,000 vehicles per day). By comparison, this 2010 traffic represents approximately 70 percent of the existing traffic of 83,000 vehicles per day in the two tunnels.

The effect during the peak hours will be more dramatic, reducing existing tunnel traffic by approximately 40 percent. The 14 hours of ator above-capacity, congested operation anticipated daily under No-Build conditions in 2010 will be reduced to one to two hours each day if a Third Harbor Tunnel is constructed. The build alternatives will not affect the High-Level Bridge backup, but will eliminate the Callahan Tunnel exit queue (northbound) and the East Berkeley Street on-ramp queue (northbound). They will reduce queues at the Northern Avenue on-ramp (northbound), the Callahan Tunnel exit (southbound), and the Haymarket on-ramp (southbound).

Overall, the Third Harbor Tunnel will significantly decrease daily traffic on portions of the Central Artery, south of the Callahan/Sumner Tunnel ramps.

In summary, the proposed project will provide additional Boston Harbor vehicular crossing capacity, which will relieve traffic pressures on the Mystic-Tobin Bridge, portions of the Central Artery, and the existing Callahan/Sumner Tunnels, and respond to the travel demand generated by continued regional growth. Because of its demonstrated need, the Third Harbor Tunnel is included in the current Transportation Improvement Program (TIP) for the Boston metropolitan area and has been proposed for inclusion in the TIP for fiscal year 1983.

2.0 DESCRIPTION OF ALTERNATIVES

2.1 ALTERNATIVES SELECTION PROCESS

The concept of a Third Harbor Tunnel under Boston Harbor has been discussed for at least 25 years. As early as 1957, with construction of the Callahan Tunnel already recommended, the MDPW predicted the need for a Third Harbor Tunnel to supplement the Sumner and Callahan Tunnels and accommodate future growth of vehicular traffic in the Boston metropolitan area. The Massachusetts Turnpike Authority studied the feasibility of a Third Harbor Tunnel in 1968 and recommended construction of such a tunnel by the early 1970's to connect the Central Artery, Massachusetts Turnpike, and Southeast Expressway with the East Boston Expressway (Route 1A) and Logan Airport. In the same year, the Eastern Massachusetts Regional Planning Project conducted by the MDPW, the Massachusetts Bay Transportation Authority (MBTA), the Metropolitan Area Planning Council, and other agencies, recommended that a Third Harbor crossing be built sometime between 1976 and 1990.

In 1972, the Boston Transportation Planning Review (BTPR) evaluated several Third Harbor Tunnel alternatives; at that time, Governor Sargent recommended construction of a special use tunnel to the Airport subject to a freeze on parking facilities at Logan Airport and the availability of 90 percent federal funding for construction of the tunnel. BTPR also studied other options for improving cross-harbor travel service, such as express bus, limousine service, commuter rail improvements, and rapid transit improvements.

In 1974, the MDPW evaluated the feasibility of depressing the Central Artery (Interstate Route 93) as a means to alleviate Boston's downtown traffic problems.

Three separate Corridor Planning Studies (CPSs) for reconstruction of the Central Artery in the north, central, and south areas were performed between 1976 and 1978 by the Commonwealth of Massachusetts' Central Transportation Planning Staff. (A CPS is a preliminary evaluation of a project, including alternatives, to determine the most feasible alternatives for detailed evaluation in an Environmental Impact Statement (EIS).) The North Area project progressed rapidly from the CPS, through the EIS phase, and into design. (The North Area project proposes to reconstruct the I-93/U.S. Route 1 interchange in Charlestown by removal of existing interchange connections and replacement with a trumpet-type interchange, tunnels under City Square, and local circulation improvements in the City Square area itself. The design is intended to remove dangerous curves and weaving sections and will result in a safe and efficient interchange. It will also improve aesthetics and create development opportunities in this area of the city.) The Central and South Area CPSs were completed in August 1978. In response to the state's request to conduct a corridor planning study for a Third Harbor Tunnel, a new CPS was conducted which combined evaluations of a reconstructed Central Artery and tunnel options.

This CPS was performed in 1980. Thirteen alternatives were analyzed: seven alternatives addressed cross harbor traffic via a Third Harbor Tunnel; four addressed Central Artery traffic through either reconstruction as a tunnel or as an improved viaduct; one was a full build alternative addressing both the Third Harbor Tunnel and depression of the Central Artery; and one was the No-Build Alternative. These 13 alternatives were:

Alternative 1. No-Build (included deck replacement on the Central Artery).

Alternative 2. Harbor Tunnel: One-Way Fort Point Channel, East Boston Railroad Alignment.

Alternative 3. Harbor Tunnel: One-Way Fort Point Channel, East Boston Airport Alignment.

Alternative 4. Artery Modifications: One-Way Fort Point Channel, New Artery Tunnels.

Alternative 5. Artery Depressed: One-Way Fort Point Channel, New Artery Tunnels.

Alternative 6. Harbor Tunnel: Two-Way Fort Point Channel, East Boston Railroad Alignment.

Alternative 7. Harbor Tunnel: Two-Way Fort Point Channel, East Boston Airport Alignment.

Alternative 8. Harbor Tunnel: Tunnel Parallel to the Dewey Square Tunnel, East Boston Railroad Alignment.

Alternative 9. Harbor Tunnel: Tunnel Parallel to the Dewey Square Tunnel, East Boston Airport Alignment.

Alternative 10. Artery Widened: Tunnel Parallel to the Dewey Square Tunnel, Viaduct Improvements.

Alternative 11. Artery Depressed: Tunnel Parallel to the Dewey Square Tunnel, New Artery Tunnels.

Alternative 12. Full Build: Both Harbor Tunnel and Artery Improvements.

Alternative 13. Special Purpose Harbor Tunnel: Two-Way Fort Point Channel, East Boston Airport Alignment.

In addition to these highway alternatives, 11 transit options were also considered in the 1980 CPS:

1. Bus Loop at Airport - Existing Service.
2. People-Mover Loop at Airport.
3. Monorail Loop at Airport.
4. Blue Line Extension Loop at Airport.
5. Blue Line Extension to Sub-Terminal at Airport.
6. Blue Line Extension - Downtown.
7. Commuter Rail Extension between South Station and Airport.
8. Commuter Rail Extensions between North Station and Airport.
9. Commuter Rail Extension to Blue Line - North Station/South Station Connection.
10. Circumferential Transit.
11. Ferry Boat to Airport - On-Board Buses, Taxis and Limousines.

As in previous CPSs undertaken by the Central Transportation Planning Staff, a Working Committee composed of citizens, agencies, and interest groups was established to insure public participation in the CPS and planning process. The 220 members of this Working Committee were informed of the study's progress through regular mailings. Two meetings were held (in May 1980 and December 1980) for public review of the draft CPS documents, summaries of which were also mailed previously to the Working Committee. The CPS was also available for public review at various locations, including the local public libraries. An Inter-agency Committee composed of transportation agencies involved in planning in the metropolitan area, also had two meetings to review the draft documents. An additional Working Committee meeting was held at the MDPW to discuss the study's recommendations.

As a result of the analyses, and through consultations with the Working Committee and public transit operators, it was concluded that the demand for cross harbor transportation service could not adequately be

met by transit improvements alone. It was recognized, however, that transit improvements could supplement the service provided by the highway connections in the area. The analyses performed on the 13 alternatives, and the analysis assumptions, are discussed in detail in the 1980 CPS.

Existing (1977) traffic volumes on the existing roadway network were assigned to the future roadway network keeping in mind the capacity of the proposed facilities when assigning traffic. Study results indicated that future traffic volumes on portions of the Central Artery and in the Sumner and Callahan Tunnels would be dramatically reduced with construction of a Third Harbor Tunnel. This reduction in traffic volumes on portions of the highway network would result in improved level of service and safety.

Preliminary costs for the 13 alternatives were also calculated in the CPS. Construction costs were estimated to range between $52.0 million (Alternative 1: No-Build - deck replacement) and $994.7 million (Alternative 5: Artery Depressed), with the harbor tunnel alternatives falling within the $500-$700 million range. These costs were based on 1979 dollars.

Finally, potential environmental and socio-economic impacts were also assessed in a preliminary fashion for the various alternatives. Effects of construction activities as well as longer term impacts were considered.

Based on the analyses performed during the CPS, the ability of the alternatives considered to improve traffic flow conditions in the Boston area at reasonable levels of cost and social, economic, and environmental impacts, the MDPW with FHWA concurrence recommended five alternatives for further detailed analysis in an Environmental Impact Statement (EIS):

1. No-Build,

2. Westerly Tunnels with Central Artery Improvements (Fort Point Channel split alignment/East Boston railroad right-of-way) (CPS Alternative 2),

3. Easterly Tunnels with Central Artery Improvements (Fort Point Channel split alignment/Bird Island Flats area) (CPS Alternative 3),

4. Westerly Tunnel without Central Artery Improvements (two-way Fort Point Channel/East Boston railroad right-of-way) (CPS Alternative 6), and

5. Easterly Tunnel without Central Artery Improvements (two-way Fort Point Channel/Bird Island Flats area) (CPS Alternative 7).

All other alternatives were eliminated from further consideration. In Alternatives 2-5, the cross harbor tunnel will carry four lanes of traffic, two lanes in each direction. Figure 3 illustrates a proposed typical cross-section of this four lane tunnel.

These alternatives and their geographic location are described in the following sections.

2.2 ALTERNATIVE 1 - NO-BUILD

The "No-Build" Alternative proposes no new construction as part of this project, and was illustrated previously on Figure 2. Construction of a traffic management lane to improve traffic flow, generally within and between the Massachusetts Avenue and Massachusetts Turnpike interchanges on the Central Artery and Southeast Expressway, and improvements to the deck of the Central Artery will be carried out as separate projects by the MDPW. These transportation improvements are assumed as "given" future conditions for all five alternatives. Other roadway modifications, such as replacement of the Northern Avenue

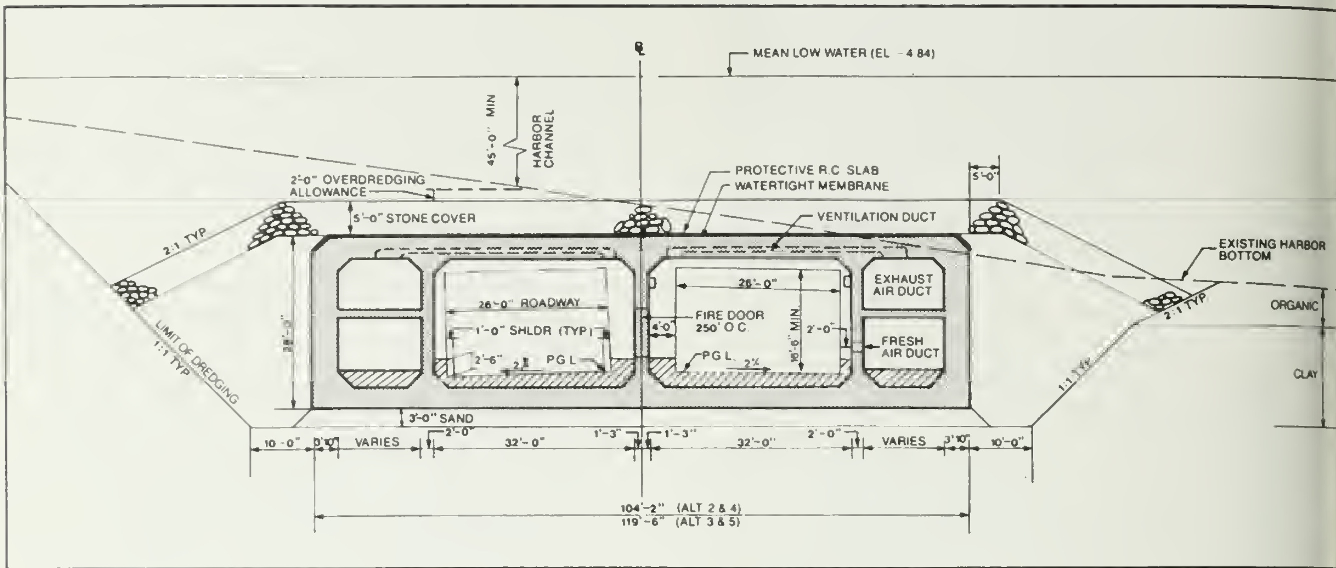


Figure 3

Typical Section—Cross Harbor Tunnel (Concrete)

EIS/EIR for I-90, The Third Harbor Tunnel

Bridge in South Boston by the MDPW, transportation improvements at South Station by the MBTA and the City of Boston, and circulation improvements at Logan Airport in East Boston by Massport have also been programmed as separate projects and have been assumed as part of the future roadway network definition. The MDPW transportation improvements are identified on Figure 4.

Also assumed to be in operation is the MDPW's Central Artery North Area Project which will bring about major transportation improvements in Charlestown.

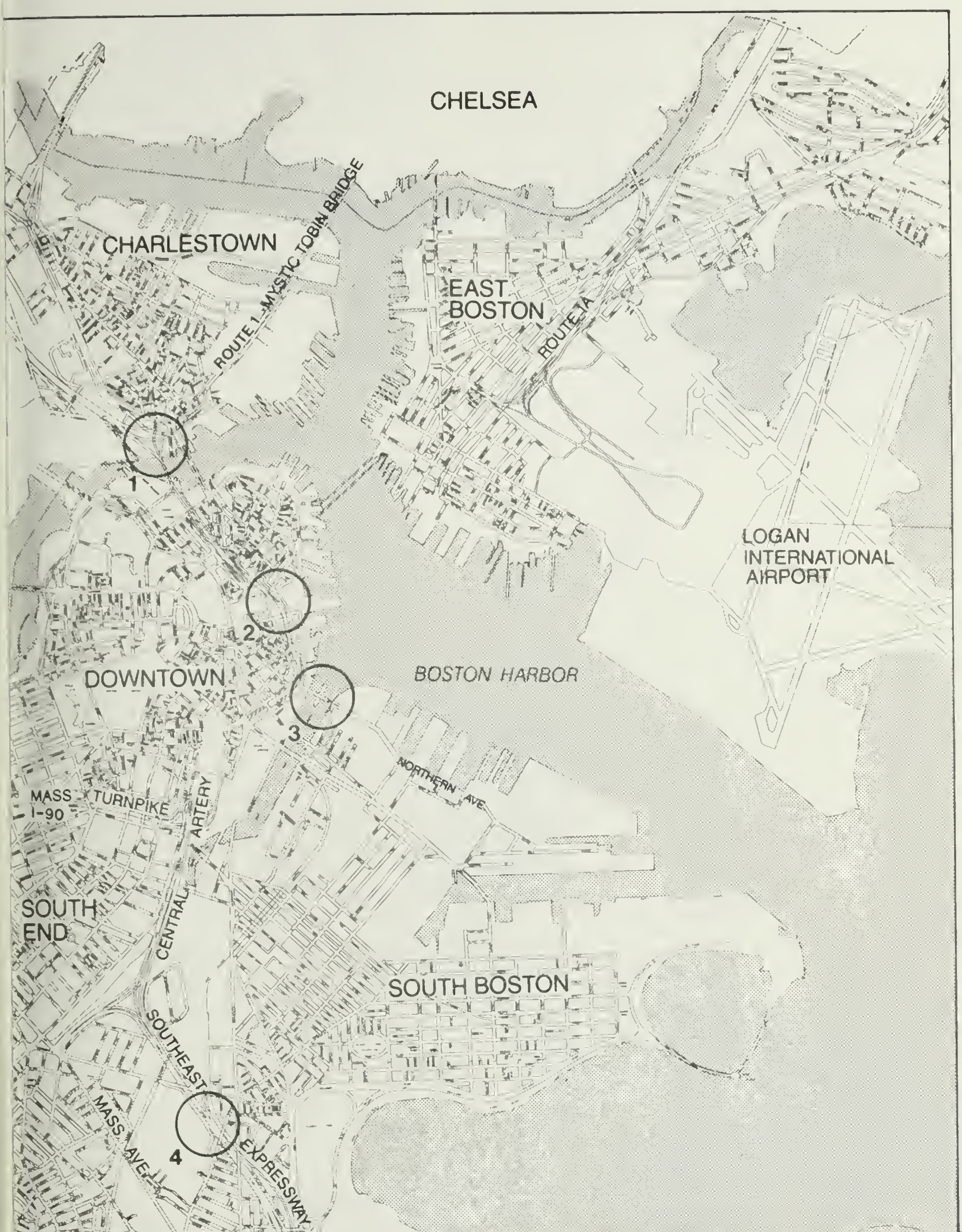
This alternative involves no construction. Annual operating and maintenance costs for the existing Callahan and Sumner Tunnels are estimated at approximately $4.6 million per year.

2.3 ALTERNATIVE 2 - WESTERLY TUNNEL WITH CENTRAL ARTERY IMPROVEMENTS (RAILROAD ALIGNMENTS)

This alternative involves construction of a new tunnel linking the Massachusetts Turnpike/Central Artery interchange area in Boston with the Route 1A area in East Boston by way of the Fort Point Channel, Boston Harbor, and the Conrail railroad right-of-way between Bremen and Orleans Street in East Boston (Figure 5).

In this alternative, all Central Artery northbound traffic from the Massachusetts Turnpike and the Southeast Expressway will be carried in a proposed five-lane, one-way toll free tunnel in the Fort Point Channel, which will split in the vicinity of Congress Street; the split (diverge) to the left (three lanes) will rejoin the existing Central Artery northbound just north of the Dewey Square tunnel, and the diverge to the right (two lanes) will continue in a tunnel (toll facility) under Boston Harbor, carrying traffic to East Boston and beyond. The new tunnel will be located along the west side of the Fort Point Channel, and will pass over the MBTA's Red Line Tunnel and under Summer Street, Congress Street, and Northern Avenue. A new bulkhead line will be constructed along the Fort Point Channel at the edge of the new tunnel.

All lanes of the Dewey Square tunnel will be converted to a one-way southbound operation. Three of these



1 North Area Project—Interchange to be Reconstructed
2 Central Artery Deck Replacement and Related Improvements
3 Northern Avenue Bridge Replacement
4 Southeast Expressway Improvement

Figure 4
MDPW Programmed Highway Projects

0 800 1600 3200 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

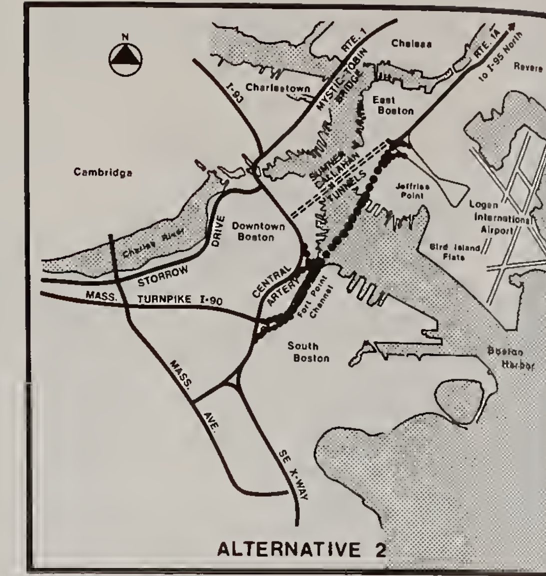


Figure 5
Alternative 2—Westerly Tunnel with Central Artery Improvements (Railroad Alignment)

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

outhbound lanes will provide access o the local streets and the Massachu-etts Turnpike while three lanes will arry Central Artery and Southeast xpressway through traffic.

Southbound traffic from East oston, Logan Airport, etc. can use he proposed cross harbor tunnel, hich diverges from the northbound unnel section as it nears downtown oston and connects to the existing entral Artery at Dewey Square. This raffic will then continue southbound n the Central Artery and Southeast xpressway.

The profile of the Third arbor Tunnel, as it passes under oston Harbor, has been established uch that it is at least seven feet elow the future 45-foot deep presently 40 feet deep) shipping hannel in the Harbor, and will not ffect maintenance dredging or future eepening to 45 feet of the adjacent 5-foot channel. Profiles are resented in the Supportive ngineering report prepared as part f this study.

Dorchester Avenue will be ebuilt directly on top of the new unnel structure in Fort Point hannel and will extend from the xisting Dorchester Avenue at roadway in South Boston to the roposed relocated Northern Avenue ridge. Northbound Central Artery raffic will gain access to relocated orchester Avenue via a new connec-ion, while a new ramp at Summer treet will provide access to the roposed tunnel (northbound only) rom the Central Business District nd the South Boston area. Relocated orchester Avenue will provide a link etween South Boston and the Central usiness District, while also roviding some relief to the Broadway nd West Fourth Street Bridges and orth-south routes in South Boston urther to the east.

Atlantic Avenue will be ebuilt from the Northern Avenue ntersection to East India Row. ccess to the Central Artery north-bound from Atlantic Avenue will be provided by a new one-lane on ramp.

On the Boston side of the Harbor, ventilation buildings are proposed in the vicinity of the tunnel portals in the South Bay area (just south of Dorchester Avenue) and at Northern Avenue. Ventilation structures are expected to be approximately 100 feet high.

As the Third Harbor Tunnel approaches East Boston, it will pass just north of East Boston Pier No. 1, and will run just east of and parallel to Bremen Street along the Conrail railroad right-of-way to a depressed toll plaza. From the toll plaza, connections passing over the MBTA's Blue Line Tunnel will be provided to and from the Airport and Route 1A. The toll plaza will be open, and will be approximately 10 feet below existing ground elevations. A new ventilation building is also proposed on top of the tunnel approximately 400 feet north of the waterfront area. This structure is also expected to be approximately 100 feet high.

A new direct connection linking Route 1A southbound traffic to the proposed toll plaza and Third Harbor Tunnel will require modifications to the existing Route 1A in the area south of Bennington Street (these modifications will allow Route 1A southbound traffic to continue to gain access to the Sumner Tunnel). A new tunnel ramp under Route 1A will also permit southbound traffic from Logan Airport to get to the new tunnel and toll plaza area. After leaving the toll plaza, southbound traffic will enter the new cross harbor tunnel roadway (parallel to the northbound tunnel roadway). As traffic approaches downtown Boston, the tunnel alignment diverges (splits) from the northbound alignment, passes under the new Central Artery northbound roadway from Fort Point Channel, and joins the existing Central Artery at Dewey Square.

As in the No-Build Alterna-

tive, roadway improvements already programmed for the area, such as replacement of the Northern Avenue Bridge, deck replacement on the Central Artery, the Southeast Expressway upgrading project, and improvements at South Station, are assumed as future characteristics of the transportation network.

The total construction-related cost of this alternative is $749 million, based on 1982 prices. This cost includes approximately $730 million for construction and $19 million for property (right-of-way) acquisition. Annual operating and maintenance costs of the existing and new tunnels with this alternative are estimated at $9.6 million per year. Tolls will be $0.50 per vehicle per direction (see Chapter 6.0).

2.4 ALTERNATIVE 3 - EASTERLY TUNNEL WITH CENTRAL ARTERY IMPROVEMENTS (AIRPORT ALIGNMENT)

This alternative will provide the same basic modifications to the Central Artery as described in the alignment of Alternative 2, including splitting the northbound traffic from the southbound traffic by construction of a one-way tunnel in Fort Point Channel, and converting the Dewey Square tunnel to a one-way southbound operation. Figure 6 presents the proposed Alternative 3 alignment.

This alternative also includes the construction of a relocated Dorchester Avenue from the vicinity of Broadway in South Boston to the relocated Northern Avenue Bridge, and the Summer Street on-ramp to the northbound tunnel. Just north of the point where the new tunnel in Fort Point Channel passes under the proposed relocated Northern Avenue Bridge, Alternative 3 follows a more easterly alignment than Alternative 2. Under Alternative 3, the tunnel will run from the mouth of the Fort Point Channel in an easterly direction across Boston Harbor towards the southwest corner of Logan Airport, to the vicinity of the Bird Island Flats. In this area, the tunnel curves toward the north and passes under Jeffries Cove and into a depressed toll plaza on Logan Airport property.

The toll plaza will be constructed in the vicinity of the existing General Aviation and Administration Building at the Airport. A ventilation building approximately 100 feet high will be located on land just north of Maverick Street.

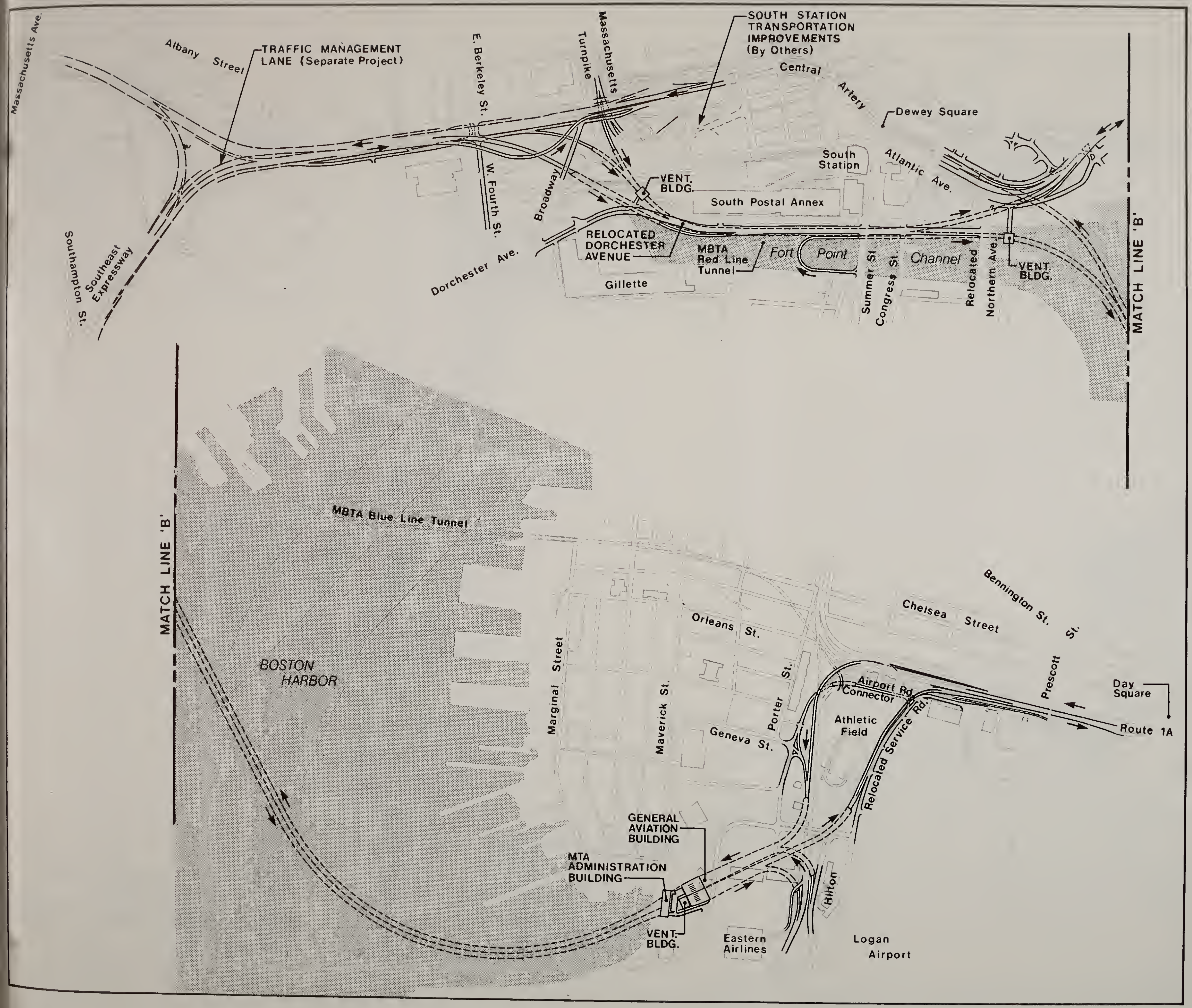
Connecting ramps both to and from the Airport, Route 1A, and East Boston will be provided at the toll plaza. Modifications to Route 1A south of Bennington Street, including the addition of a lane on both the northbound and southbound roadways, will also be made as part of this alternative.

Southbound Third Harbor Tunnel traffic will enter the southbound tunnel roadway after leaving the Airport area toll plaza. As in Alternative 2, the southbound tunnel alignment diverges from the northbound alignment as it approaches downtown Boston, and connects to the southbound Dewey Square Tunnel. Remaining improvements are the same as Alternative 2.

As in Alternative 2, the profile of the Third Harbor Tunnel under Boston Harbor has been established so that it does not inhibit navigation or potential deepening of the Boston Harbor shipping channel.

Because of the connections at the Airport, traffic circulation improvements within the Airport and to and from East Boston will be provided as part of this project. These include a relocated Service Road (running north and east of the Airport egress road) and a new circulation road (Airport Road Connector).

The total construction-related cost of this alternative is $945 million, based on 1982 prices. This cost includes approximately $919 million for construction and $26



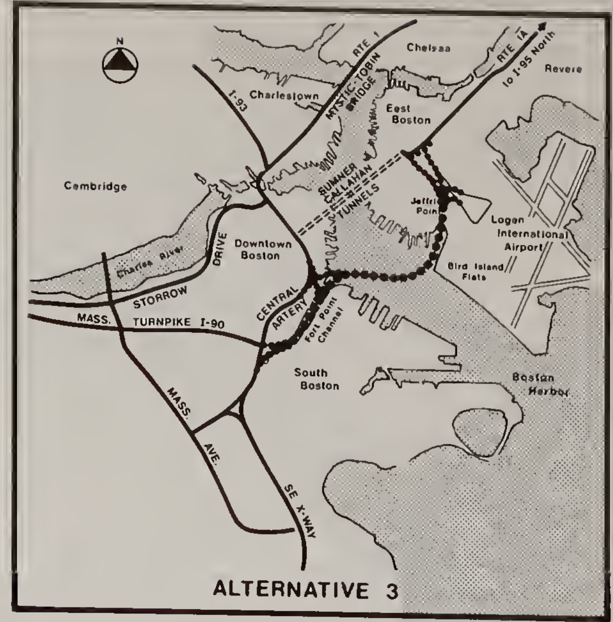
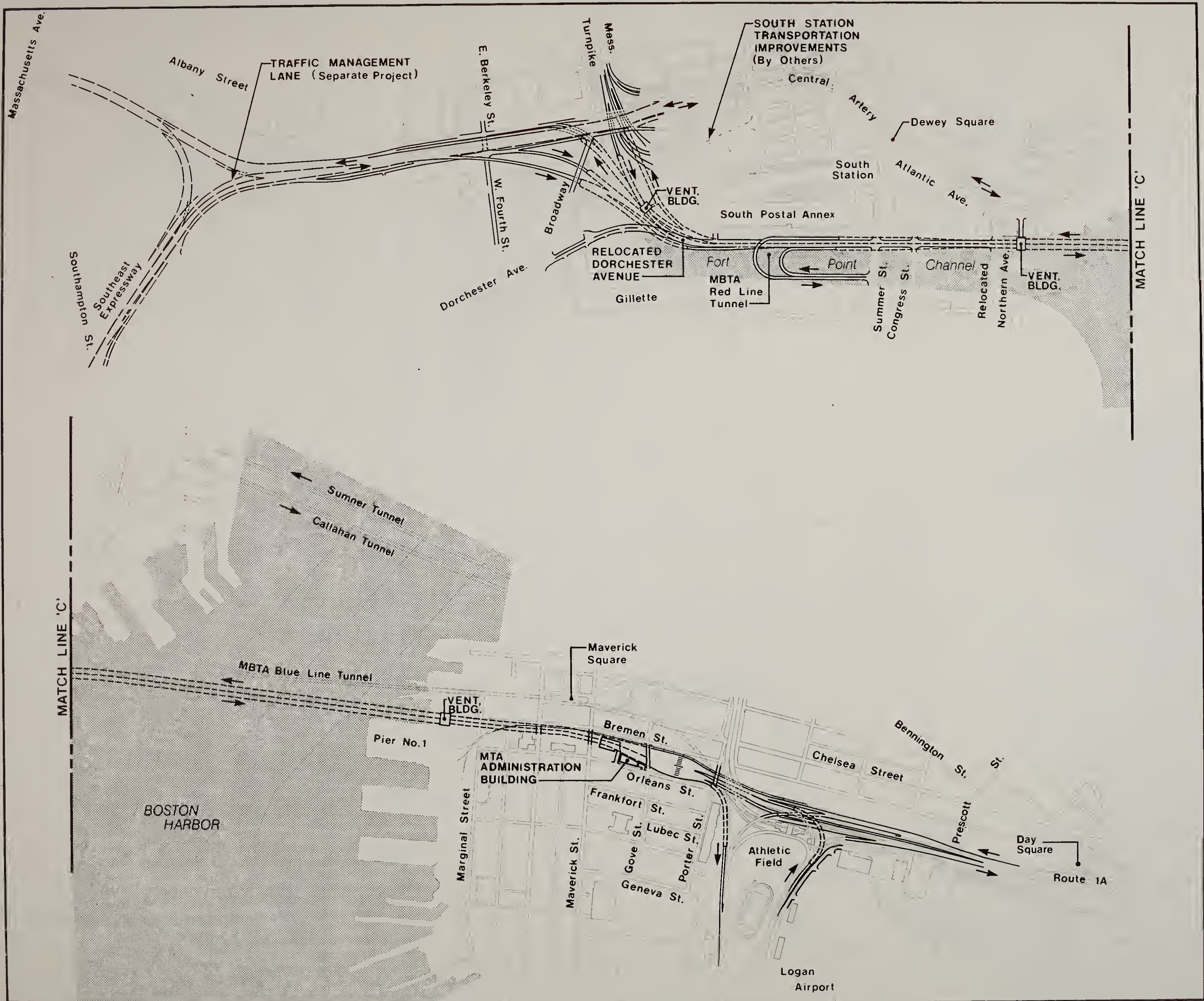


Figure 6
Alternative 3 — Easterly Tunnel with Central Artery Improvements (Airport Alignment)

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel



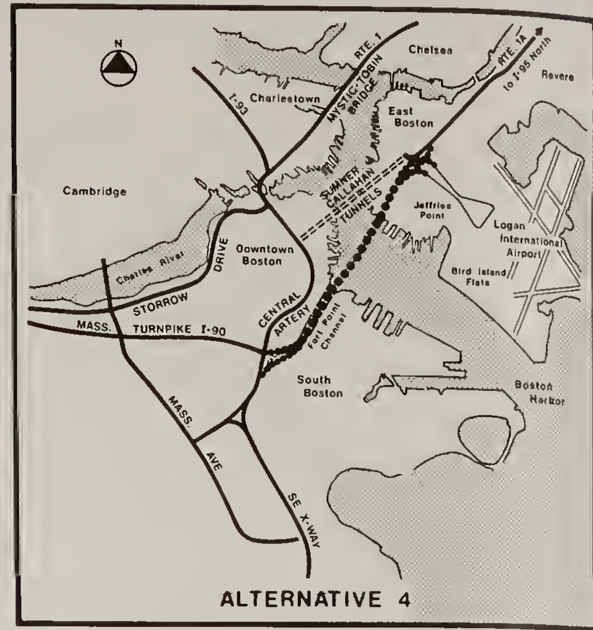


Figure 7
Alternative 4—Westerly Tunnel without Central Artery Improvements (Railroad Alignment)

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

million for property (right-of-way) acquisition. Annual operating and maintenance costs of the existing and new tunnels with this alternative are estimated at $9.75 million per year. Tolls will be $0.55 per vehicle per direction (see Chapter 6.0).

2.5 ALTERNATIVE 4 - WESTERLY TUNNEL WITHOUT CENTRAL ARTERY IMPROVEMENTS (RAILROAD ALIGNMENT)

This alternative is very similar in alignment to Alternative 2 described previously. Alternative 4, however, proposes no modifications on the Central Artery north of the Massachusetts Turnpike interchange. Instead, Alternative 4 carries two-way traffic in a new tunnel in the Fort Point Channel and maintains the current two-way traffic flow directions on the Central Artery in the Dewey Square tunnel. The alignment is presented in Figure 7.

A four-lane, two-way tunnel will be located along the west side of the Fort Point Channel; passing over the MBTA Red Line Tunnel and under Summer Street, Congress Street, and Northern Avenue; and proceeding directly into Boston Harbor. Dorchester Avenue will be relocated and built on top of this tunnel box section, similar to the previous build alternatives.

As in Alternatives 2 and 3, a new bulkhead line will be constructed along the Fort Point Channel at the edge of the new tunnel.

The portion of the Alternative 4 alignment which passes under Boston Harbor and into the East Boston area, ultimately connects to Route 1A in East Boston and is identical to this portion of Alternative 2 (occurring within the railroad right-of-way). The toll plaza will also remain the same. Profiles under Boston Harbor will be below the main shipping channels.

Southbound traffic from Route 1A and Logan Airport will gain access to the toll plaza and southbound cross harbor tunnel roadway in the same manner as in Alternative 2. As the southbound traffic approaches downtown Boston, however, it will continue traveling south in the Fort Point Channel instead of diverging from the northbound alignment as in Alternative 2. Direct connections will be provided for this southbound traffic to gain access to the Massachusetts Turnpike westbound, the Central Artery/Southeast Expressway southbound, and Albany Street.

Onand off-ramps will be provided at Summer Street for access between the Third Harbor Tunnel, South Boston, and the Central Business District.

The total construction-related cost of this alternative is $735 million, based on 1982 prices. This cost includes approximately $731 million for construction and $4 million for property (right-of-way) acquisition. Annual operating and maintenance costs of the existing and new tunnels with this alternative are estimated at $9.6 million per year. Tolls will be $0.50 per vehicle per direction (see Chapter 6.0).

2.6 ALTERNATIVE 5 - EASTERLY TUNNEL WITHOUT CENTRAL ARTERY IMPROVEMENTS (AIRPORT ALIGNMENT)

On the Boston side of the Harbor, Alternative 5 is identical to Alternative 4, carrying two-way traffic in a new four-lane tunnel in the Fort Point Channel (see Figure 8).

On the East Boston side of the Harbor, the features of Alternative 5 are identical to those of Alternative 3, with a new toll plaza on airport property.

The total construction-related cost of this alternative is $927 million, based on 1982 prices. This cost includes approximately $915 million for construction and $12 million for property (right-of-way) acquisition. Annual operating and maintenance costs of the existing and proposed tunnels of this alternative

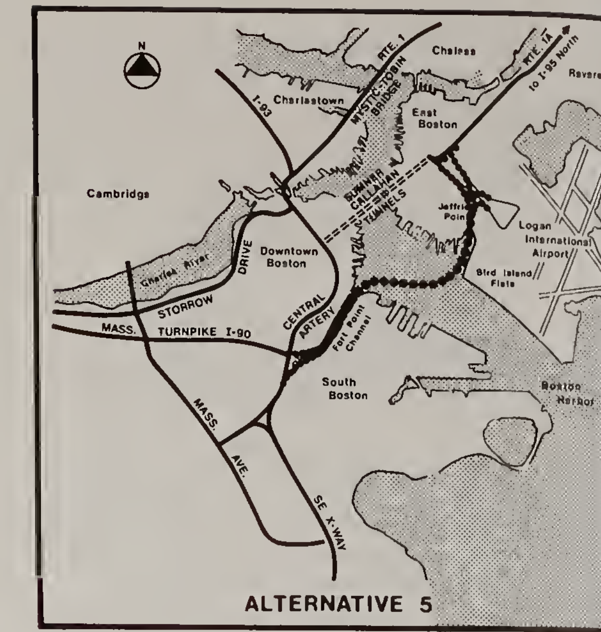


Figure 8
Alternative 5—Easterly Tunnel without Central Artery Improvements (Airport Alignment)

0 250 500 1000 Feet

7

EIS/EIR for I-90, The Third Harbor Tunnel

are estimated at $9.75 million per year. Tolls will be $0.55 per vehicle per direction (see Chapter 6.0).

2.7 DESIGN CONSIDERATIONS

Decisions related to the design and construction methods made for the build alternatives during the Supportive Engineering phase of this study were based on several factors, primary of which are design criteria established by the American Association of State Highway and Transportation Officials (AASHTO) and the Massachusetts Department of Public Works (MDPW). Other factors considered included costs, engineering feasibility, compatibility with other projects, design standards adopted by other projects of similar construction, minimization of environmental impacts, and input from state and city agencies. (It should be noted that the shoulders in the proposed tunnels are not full width, and the 22 mph speed reduction curve for loaded trucks has been used for design.)

The major location and design refinements are described below.

Northern Avenue Ramps - Summer Street Ramps

In order to encourage use of the Third Harbor Tunnel by traffic from Boston's financial district, and to improve accessibility of the South Boston development areas to the regional highway network, ramp access has been provided from Summer Street in South Boston to the Third Harbor Tunnel. Traffic on the new Summer Street ramp(s) is projected to serve approximately 9,000 - 11,000 vehicles per day in 2010; without these ramps, this traffic would continue to use the Callahan and Sumner Tunnels and local downtown Boston streets to gain access to the Financial District and South Boston, further aggravating the heavy traffic volumes on these facilities. It is also possible that the absence of these ramps could inhibit the future development efforts ongoing in this part of the City due to reduced accessibility.

Local access to and from the proposed tunnel in the Fort Point Channel was initially considered at the proposed new Northern Avenue bridge. However, because of tunnel and ramp profile grade differences, construction of the ramps in this location would require that a 1200-foot long bulkhead be constructed into Boston Harbor to protect the tunnel structure. This finger-like jetty extending into the Boston Harbor would have eliminated water access to Rowe's and Foster's Wharves.

Successful redevelopment of land parcels fronting on the Fort Point Channel in this area is dependent upon their retaining water access. Following consultation with the Boston Redevelopment Authority (BRA), proposed ramp access to the tunnel was shifted to Summer Street. Several ramp alignments connecting the tunnel with Summer Street were investigated, including long access roads along Fort Point Channel with a loop road around the southern end of the Channel near the Gillette Co.; short access roads along the Channel with a new bridge across it connecting to A Street in South Boston; and bridges similar to those shown in the build alternatives but looping into the Rose Properties parcel in South Boston. These alternatives were rejected in favor of the design presented in plans of the build alternatives for various reasons, including impacts on private property (property acquisition), geometrics, and cost.

The Summer Street location maintains complete water accessibility to Rowe's and Foster's Wharves. In addition, ramps at this location permit a lower tunnel profile in the mouth of the Fort Point Channel, eliminating the need for a breakwater in this area. It also eliminates long-term impacts which would have resulted to a Coast Guard anchorage area at the mouth of the Fort Point Channel.

Relocated Dorchester Avenue

Relocated Dorchester Avenue is an integral part of the Third Harbor Tunnel project because it both mitigates local (South Boston/Fort Point Channel) traffic access and circulation problems, and provides access to the Third Harbor Tunnel ramp(s) at Summer Street from Downtown Boston and South Boston.

By providing the direct ramp connection to relocated Dorchester Avenue from the Southeast Expressway/ Central Artery, short-cutting through traffic which presently uses lower Dorchester Avenue, the Broadway and West Fourth Street Bridges, and other local South Boston streets to get to the northern sector of South Boston can remain on the Expressway/Artery and the Frontage Road. Dorchester Avenue's reconnection at Summer Street improves access between South Boston and the downtown area by nature of its direct connection and the reduced traffic on the Broadway and West Fourth Street Bridges. This improvement in the northbound direction will further ease both through traffic and commercial traffic pressures on local South Boston residential streets, since it confines this traffic to the Fort Point Channel/South Bay industrial corridor. Finally, circulation and access between downtown Boston, South Boston, and the proposed tunnel requires increased roadway capacity parallel to Fort Point Channel which present Atlantic Avenue on the Boston side and Sleeper and other streets on the South Boston side cannot provide.

Profiles in Fort Point Channel/MBTA Red Line Crossing and Boston Harbor

Red Line Crossing

Two profiles were developed for the crossing of the MBTA's Red Line tunnel in the Fort Point Channel. A "low profile" tunnel constructed by boring with minimal surface disturbance (driven-shield bored-tunnel method) would cross under the Red Line at Summer Street. A "high profile" tunnel would cross over (span) the Red Line tunnel as a shallow, cut-and-cover tunnel section supported on piles. The high profile was ultimately selected.

Low Profile. Since the low profile would not allow reconnection to the Central Artery within acceptable design parameters (e.g., speed reductions were greater than 20 miles per hour) for the split alignments (Alternatives 2 and 3), the low profile was only considered for Alternatives 4 and 5 (two-way alignments) which do not require reconnection to the Central Artery. The minimum cover and clearance criteria (one diameter -- in this case, 38 feet) resulted in a very deep structure with steep profile grades for the proposed ramps and connectors to the tunnel and unacceptable speed reductions. The low profile also prevented ramp connections to and from Summer Street.

Settlements within the zone of influence of the bored tunnel tube could cause damage to the MBTA Red Line tunnel; to the Summer Street, Congress Street and Northern Avenue Bridges; and to the entire length of the existing bulkhead along Dorchester Avenue. Significantly increased construction costs would also result from driving the tunnel through the Fort Point Channel due to the existing soil conditions. Large cofferdam construction (100-120 feet in depth and diameter) would also be necessary to allow construction of the ventilation building in this area, significantly affecting construction costs.

High Profile. Geotechnical and structural studies indicate that the integrity of the Red Line tunnel will not be affected if the Third Harbor Tunnel is constructed by spanning over the Red Line tunnel with pile supports on either side. Dredging limits near the Red Line in Fort Point Channel were set to avoid effects on the Red Line Tunnel during construction. Relocated Dorchester Avenue can also be constructed

directly on top of the tunnel in this area. At low tide, the top of the tunnel box would have been visible.

Since construction period impacts to the bridges, bulkhead, and MBTA tunnel referred to above can be minimized, and since the proposed tunnel structure can be used to support relocated Dorchester Avenue, the high profile in Fort Point Channel was selected for final development.

Boston Harbor

Two profiles were also investigated under Boston Harbor: a shallow, sunken tube (high profile) tunnel, and a deep (driven-shield) bored tunnel (low profile). The sunken tube tunnel (either reinforced concrete or steel) would consist of two parallel roadways in a 28- to 35-foot high by 88- to 120-foot wide (approximately) prefabricated structure with a minimum cover (material placed above the top of the tunnel structure) over the top of the tunnel of 7 feet below the proposed deepened shipping channel in Boston Harbor. The deep bored tunnel would consist of twin 38-foot diameter steel tubes with a minimum cover of one tube diameter.

The bored tunnel, or low profile method, is not feasible due to existing soil conditions; construction problems; and unacceptable highway design aspects, including significant speed reductions, associated with this tunnel method.

By comparison with bored tunnel methods for this project, the sunken tube method is significantly less complex and technically demanding, and involves less risk of time consuming and costly delays due to construction problems. Provisions for maintaining nearly continuous shipping and other navigation in Boston Harbor can also be made with the sunken tube construction method.

It is conceivable that the tunnel could be constructed without having to close more than half of the 1200-foot shipping channel at any time. However, due to the precision required in placing (sinking) the tunnel sections and possible safety problems, the channel should be closed to navigation during this operation, which could be completed in approximately one day per tunnel section. Continued discussion and coordination of this construction process with the Coast Guard will be required.

Toll Plazas - Boston

Toll plazas on the Boston side of the Harbor were considered for all of the build alternatives. Two of the locations considered were: 1) at the mouth of the Fort Point Channel between Northern Avenue and Rowe's Wharf, and 2) in the South Bay area.

Placing the toll plazas at the mouth of the Fort Point Channel would require lowering the tunnel and Summer Street ramp profiles necessitating extensive and costly cofferdam construction, interfering with marine operations in the area and significantly affecting both Rowe's and Foster's Wharves. Since the toll plazas would be under water and would be covered, they would be significantly more costly when compared to toll plazas on land in East Boston.

A toll plaza location serving all of the roadway connections required between the new tunnel and the Massachusetts Turnpike, Southeast Expressway, Central Artery, and local streets was not possible in the South Bay area. In addition, the increased size of the construction area would affect the operations of many of the railroad services (Amtrak, Conrail, MBTA Commuter Rail, MBTA Red Line, etc.) in this area.

Toll plazas on the Boston side of the Harbor were therefore eliminated from further consideration. Adequate land area for the proposed toll plazas exists on the East Boston side of the Harbor where physical connections to the area's roadways

can better be accommodated in conformance with established design criteria for toll plazas.

Alternatives 2 and 4 - East Boston, MBTA Blue Line Tunnel Crossing

The East Boston section of the MBTA Blue Line subway tunnel at Porter Street presents a physical barrier to ramps carrying traffic between the Third Harbor Tunnel and Route 1A. Design profiles for the ramps and toll plaza are therefore governed by the existing Blue Line tunnel.

Both high (over) and low (under) profiles were studied; the high profile was ultimately selected.

Severe construction impacts associated with the low profile were identified. State-of-the-art construction techniques and underpinning methods, resulting in both significantly increased construction periods and costs (an additional $100 million), would have to be used to pass the ramps under the MBTA's Blue Line tunnel. Underpinning would require use of needle beams supported from reinforced concrete beams on concrete caissons or slurry walls for support. Construction over the Blue Line tunnel would utilize standard construction methods and would not require any underpinning. The low profile has a much higher risk of damage to the Blue Line tunnel during construction since the entire tunnel section must be exposed to allow for a new support system to be placed beneath it. The high profile, however, would expose only the top of the Blue Line tunnel and would involve only a minimum degree of risk associated with this type of construction procedure.

In addition to these factors, increased risk for settlement and damages to other buildings in the area would also result with the low profile.

Alternatives 3 and 5 - East Boston, Airport Alignment

The airport alignment (Alternatives 3 and 5) passes beneath Jeffries Cove and continues onto Logan Airport property for toll collection at what is now the General Aviation Building site. The reasons why the current alignment was selected over the other two options, a less desirable Jeffries Cove option and a Bird Island Flats option, are explained in this section.

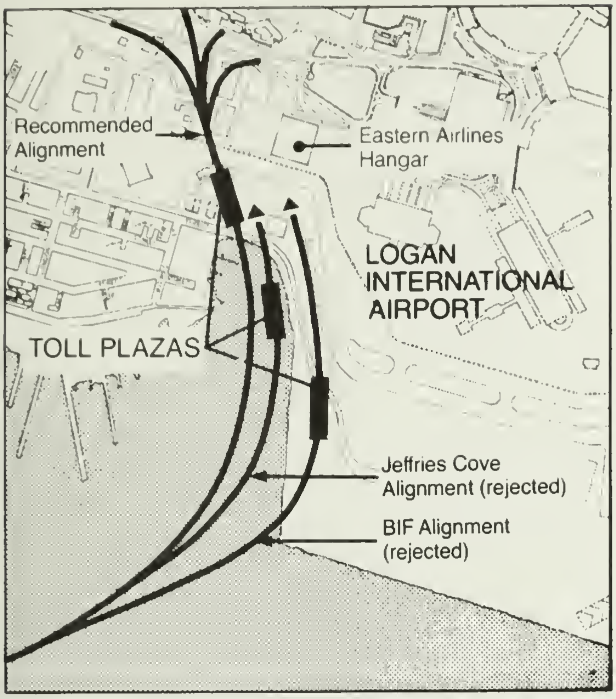
The original Jeffries Cove option would have required filling part of the Cove for construction of a toll plaza, thus curtailing existing boating and recreation activities and detracting from the Cove's aesthetic qualities. Several other considerations also made the present alignment more desirable.

- The ventilation building previously proposed to be placed in Jeffries Cove, can now be placed on land at the airport;
- Eastern Airlines hangar operations will not be affected; and
- The tunnel roof will not be required to withstand airplane loading.

A Bird Island Flats (BIF) option was also studied and subsequently rejected. The BIF option included a depressed toll plaza on airport property. Although a corridor had been temporarily reserved for the tunnel, its construction would interfere with ongoing development on BIF. Significant impacts would result also on Eastern Airlines' operations. Because of these factors, as well as improved horizontal and vertical alignment and toll plaza location associated with the selected option, the BIF option was eliminated.

The recommended Alternative 3

option at Jeffries Cove, as well as the other options evaluated and subsequently rejected, is exhibited below.



Conrail Wye Connector

The Wye Connector, proposed by the Massachusetts Bay Transportation Authority (MBTA) to allow freight and passenger train movements to ocur while bypassing the South Station yards, will be affected by all build alternatives proposed for the Third Harbor Tunnel. The connecting roadways from the Southeast Expressway and the Massachusetts Turnpike to the Third Harbor Tunnel will pass under the Wye Connector. It is expected that construction of the Wye Connector will precede construction of the Third Harbor Tunnel. Therefore, a temporary rail line is proposed as part of the tunnel project to maintain service along the Wye Connector during construction of the proposed connecting roadways.

Combined Sewer Overflow Facilities

The proposed combined sewer overflow (CSO) treatment facility in South Bay will be constructed after the Third Harbor Tunnel project is completed. The build alternatives have been developed to ensure that adequate space is provided to accommodate the CSO treatment facility.

A CSO pipeline is also proposed from the vicinity of High Street in Boston to the treatment facility in South Bay. This pipeline can be located in either the Fort Point Channel or in existing Dorchester Avenue. Construction of the new tunnel will not preclude the future construction of this pipeline.

Provisions for accommodating the existing outfalls into the Fort Point Channel will also be made in the design of the tunnel.

The proposed CSO Treatment Facility on Bird Island Flats in East Boston will also occur after construction of the tunnel. The location of this CSO facility (under the airport alignment) will not be affected by the tunnel project, although the profile of the proposed CSO pipeline to the treatment facility may have to be altered because of the new tunnel.

Tunnel Utilities

Tunnels for the various alternatives will contain no hazardous transmission mains or pipelines that could create a hazard to vehicle drivers in the event of a break or rupture. The tunnel will contain water lines for fire protection as well as drainage lines and pumps. Lighting, ventilation, T.V. monitoring and communications facilities will be provided. The tunnel will have safety walks located on both sides of the roadways but there are no emergency access points except at the mainline and ramp portals, and there are no breakdown lanes provided.

Relationship to Other Projects

The Commonwealth of Massachusetts Executive Office of Environmental Affairs' (EOEA's) scope for this

study required the evaluation of the Third Harbor Tunnel project's relationship to other proposed projects, such as the proposed CSO facilities, the Wye Connector, and dredging of the Boston Harbor shipping channel. Other projects have also been considered during the refinement of the alternatives.

This project is compatible with the proposed Northern Avenue Bridge replacement project, the design of which will include provisions for the tunnel to pass under without disrupting the new bridge. The proposed relocated Dorchester Avenue on top of the tunnel, with intersections at Summer Street, Congress Street, and Northern Avenue, will effectively link the Southeast Expressway, Massachusetts Turnpike Extension, and Central Artery to the industrial area of South Boston.

As mentioned in Section 2.2, other proposed transportation improvements are expected to occur as separate projects regardless of the Third Harbor Tunnel. These improvements are expected to be completed or nearing completion prior to construction of the new tunnel, and include: redecking of the Central Artery, construction of traffic management lanes on the Southeast Expressway and part of the Central Artery (south of Dewey Square Tunnel), and construction of the Central Artery North Area Project. The Third Harbor Tunnel alternatives have also been developed and refined to be compatible with these projects.

Effects on proposed developments, such as the East Boston Piers, the South Station project, and the Bird Island Flats project as well as impacts on existing structures are evaluated in this document.

3.0 AFFECTED ENVIRONMENT

3.1 TRANSPORTATION FACILITIES

3.1.1 Existing Roadway Characteristics

Affected Roadway Network

The affected roadway network identified for this project was generally shown on Figure 2 (i.e., that system of roadways whose traffic is to be influenced by the Third Harbor Tunnel). Presently, there are three roadway facilities crossing Boston Harbor which provide north-south connections between communities north-northeast and south-southwest of Boston. These are the Mystic-Tobin Bridge (U.S. Route 1) and the Callahan/Sumner Tunnels (State Route 1A), the latter of which are two separate facilities that operate as a one-way pair. Each of these facilities connects with the Central Artery (Interstate Route 93), the major north-south highway through the Boston Central Business District, and link the Southeast Expressway (Interstate Route 93/State Route 3) to the south with Interstate Route 93 and U.S. Route 1 to the north. The Massachusetts Turnpike (Interstate Route 90) links the three harbor crossings with communities west of Boston via the Central Artery.

The affected roadway network also includes Route 1A and Storrow Drive, as well as arterial and collector roadways in East Boston, South Boston, and downtown Boston. North of East Boston, Bell Circle in Revere is included (not shown on Figure 2) because it is a decision point where motorists can choose between the Callahan/Sumner Tunnels and the Mystic-Tobin Bridge, depending on congestion levels on either facility.

The traffic conditions of 54 key highway links or ramps and 42 key at-grade intersections within the affected roadway network have been analyzed. Figure 9 identifies these 96 locations.

Hazardous Cargo Routes

Vehicles carrying hazardous cargoes are prohibited from using the Callahan and Sumner Tunnels, as well as the Dewey Square Tunnel. Because of this restriction, a number of alternative routings for such vehicles exist. Vehicles carrying hazardous cargo presently between East Boston or Revere and Boston utilize the Mystic-Tobin Bridge instead of the Callahan and Sumner Tunnels to cross the Boston Harbor. To avoid the Dewey Square Tunnel, these vehicles use surface streets such as High Street, Purchase Street, Atlantic Avenue, Surface Artery, and Kneeland Street.

Existing Traffic Volumes

Table 1 tabulates 1982 Average Weekday Daily Traffic (AWDT) volumes and truck composition for the key major highway links and city streets on the affected roadway network. Also listed are predicted future traffic volumes (1990 and 2010) without the Third Harbor Tunnel project (i.e., the No-Build Alternative).

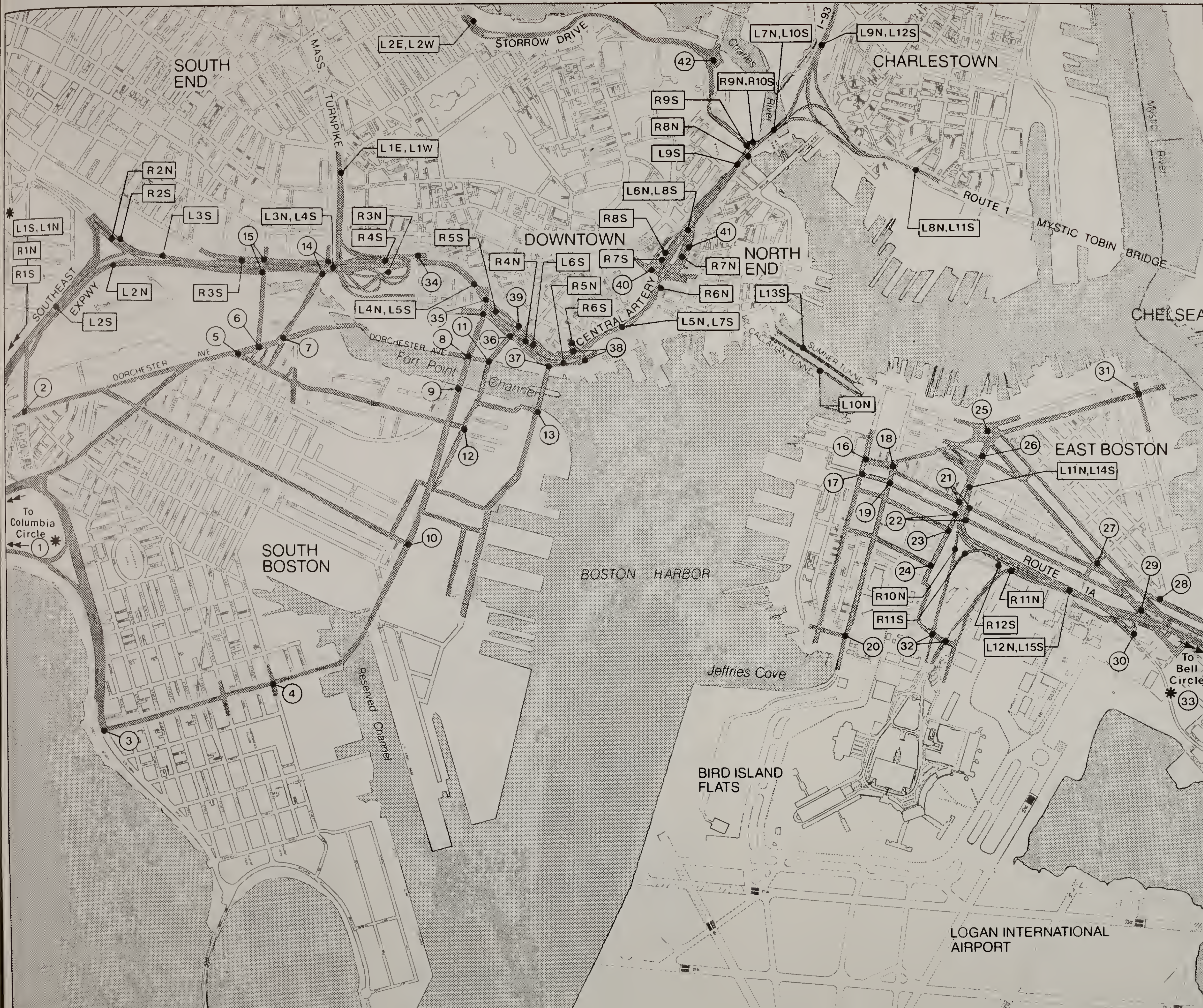
As is evident from Table 1, the Central Artery and Southeast Expressway carry the highest traffic volumes in the area, their AWDT's varying between 142,100 vehicles per day (vpd) and 166,200 vpd between the I-93/Mystic-Tobin Bridge merge on the Central Artery and the Columbia Road interchange on the Southeast Expressway. The Callahan/Sumner Tunnels carry a 1982 volume of 82,800 vpd, and the Massachusetts Turnpike has an AWDT volume of 71,200 vehicles just west of the Central Artery interchange.

Seven to eight percent of the total daily traffic on the Artery/Expressway is truck traffic. On the Massachusetts Turnpike, approximately nine percent is trucks (one-half of which are heavy trucks). In the Callahan/Sumner Tunnels, three percent is trucks. This low percentage of trucks in the tunnels is primarily a

Table 1

AVERAGE WEEKDAY DAILY TRAFFIC (AWDT)
1982, 1990, 2010

	Existing 1982		No-Build Alternative 1990			2010		
Roadway Link	AWDT*	% Trucks	AWDT*	% Change vs. 1982	% Trucks	AWDT*	% Change vs. 1982	% Trucks
Sumner/Callahan Tunnels	82,800	3	83,600	+ 1.0	3	91,800	+11.0	3
Mystic-Tobin Bridge - north of I-93 Ramps	72,500	6	73,900	+ 2.0	8	79,100	+ 9.0	8
I-93 - north of Mystic-Tobin Bridge Ramps	89,450	7	102,200	+14.0	8	106,000	+18.5	8
Central Artery -								
between I-93 & Storrow Drive Ramps	142,100	7	148,300	+ 4.5	8	153,800	+ 8.0	8
between Causeway St. & Sumner/Callahan Ramps	161,700	8	167,500	+ 3.5	8	173,100	+ 7.0	8
between Callahan/Sumner & High St. Ramps	164,500	8	169,800	+ 3.0	8	173,400	+ 5.5	8
between Atlantic Ave. & Beach St. Ramps	166,200	7	169,500	+ 2.0	8	173,100	+ 4.0	8
between Albany St. & Mass Ave. Ramps	153,700	7	167,200	+ 9.0	8	169,400	+10.0	8
Southeast Expressway -								
between Columbia Rd. & Southampton St. Ramps	162,300	7	168,000	+ 3.5	8	170,900	+ 5.3	8
south of Columbia Rd. Ramps	151,620	7	156,900	+ 3.5	8	159,650	+ 5.3	8
Massachusetts Turnpike - west of Central Artery	71,200	9	79,600	+12.0	8	80,000	+12.5	8
Storrow Drive - west of Copley Ramps	84,000	0	86,100	+ 2.5	0	90,600	+ 8.0	0
Route 1A - north of Neptune Road	30,825	3	35,800	+16.0	3	40,000	+30.0	3
Logan Airport Access/Egress Roads (Main)	55,450	2	66,300	+20.0	2	82,100	+48.0	2
Porter St. - between Cottage & Wellington Sts.	8,425	5	10,000	+18.7	5	11,700	+38.9	5
Maverick St. - between Cottage & Orleans Sts.	4,200**	5	4,300**	+ 2.4	5	4,700**	+12.0	5
Sumner St. - between Orleans & Cottage Sts.	2,400**	5	2,500**	+ 4.2	5	2,700**	+12.5	5
Meridian Street - northwest of Condor Street	15,100	5	17,700	+17.2	5	18,300	+21.2	5
Bennington Street - west of Route 1A	19,125	5	20,000	+ 4.6	5	21,100	+10.0	5
Columbia Road - north of Columbia Circle	21,750	2	25,875	+19.0	2	27,350	+25.7	2
L Street - north of Day Boulevard	12,325	1	13,825	+12.0	1	14,150	+14.8	1
East First Street - west of Summer Street	2,900	21	4,550	+57.0	21	4,800	+65.5	21
D Street - southwest of Summer Street	6,500	8	9,925	+52.6	13	10,900	+67.7	13
Summer Street - at Fort Point Channel	27,000	10	35,475	+31.4	8	36,450	+35.0	8
Congress Street - at Fort Point Channel	11,000	9	14,550	+32.3	15	15,550	+41.4	15
Northern Avenue - at Fort Point Channel	18,050	8	30,250	+67.6	8	32,250	+79.2	8
Dorchester Avenue - south of A Street	23,450	6	25,450	+ 8.5	5	25,650	+ 9.4	5
Frontage Road - approach to W. Fourth St. Bridge	26,950**	11	27,200	+ 1.0	11	27,600	+ 2.5	11
West Fourth Street Bridge	11,000	12	10,650	- 3.2	13	10,650	- 3.2	13
Broadway Bridge	20,600	13	26,150	+26.9	10	26,150	+26.9	10
Atlantic Avenue - between Summer & Congress Sts.	16,900**	10	20,300**	+20.1	10	20,700**	+22.5	10
Seaport Access Road - southwest of Summer St.	N/A	-	8,300	-	11	9,300	-	11



* Beyond Map Limits:

- L1N S.E. Expressway, Between Columbia On- and Southampton Off-Ramps.
- L1S S.E. Expressway Between Southampton On- and Columbia Off-Ramps.
- R1N Columbia Road Off-Ramp-Northbound
- R1S Columbia Road On-Ramp-Southbound
- (1) Columbia Circle
- (33) Bell Circle, Revere

Figure 9
Affected Roadway Network – Roadway Link, Ramp, and Intersection Identification Map

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend

- (1) Existing Intersection
- L1N Existing Roadway Link or Ramp
- Affected Roadway Network

result of the restrictive clearance in the existing tunnels, and secondarily due to restrictions on trucks carrying hazardous cargoes through the tunnels.

AWDT volumes and truck percentages for selected roadways in East Boston and South Boston are also included in Table 1. Truck traffic on most East Boston roadways accounts for approximately five percent of the total daily traffic. However, Route 1A and the airport access/egress roads respectively carry only three percent and two percent trucks, due to the hazardous cargo and physical restrictions in the tunnels and the preponderance of auto-sized traffic destined to the airport. AWDT volumes for selected roadways in South Boston are also shown in Table 1. AWDT volumes on major roadways typically vary between 12,000 and 27,000 vpd. Traffic on these South Boston roadways, such as Columbia Road, L Street, Summer Street, Congress Street, Northern Avenue, and Dorchester Avenue, is significantly affected by operating conditions on the Central Artery/Expressway and in the existing tunnels, as drivers attempt to avoid congestion by diverting to local roadways. Truck traffic in South Boston is more varied than in East Boston, ranging from less than 1 percent trucks for L Street to 21 percent trucks for East First Street. These varying characteristics can be attributed to the industrial character of the northern parts of South Boston, as well as truck restrictions/truck routes in the area.

Traffic Levels of Service: Definition

In traffic engineering practice, six discrete levels of service describe traffic operating conditions along roadways and at signalized and unsignalized intersections. The six levels, represented by the letters A through F, range from free-flow to jammed conditions and are illustrated on Figure 10 for a typical highway section.

To estimate level of service, two parameters must be determined: (1) volume-to-capacity (v/c) ratio and (2) operating speed. The v/c ratio indicates what portion of a highway segment's theoretical capacity is being used by the traffic demand volume on that segment. It provides an isolated determination of level of service on a highway link but does not indicate the effects of downstream congestion or bottlenecks on that section. Operating speed reflects the effects of downstream bottlenecks on the highway section under consideration. Consequently, operating speed can provide a more precise determination of the actual level of service, particularly on highways where onand off-ramps are numerous and closely spaced. Ramp junctions too are evaluated for level of service, in terms of merge, diverge, and weaving conflicts.

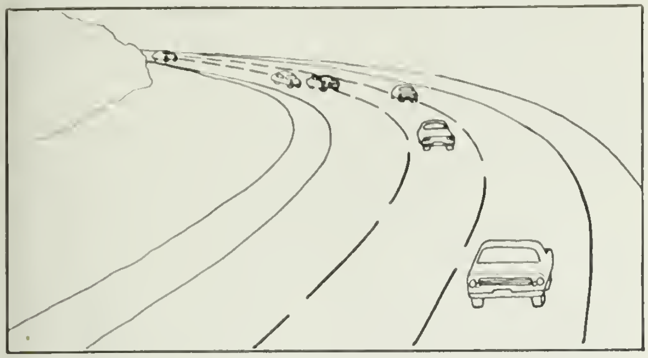
Existing V/C Ratios and Levels of Service

Table 2 presents v/c ratios, average operating speeds, and levels of service for the affected roadway network.

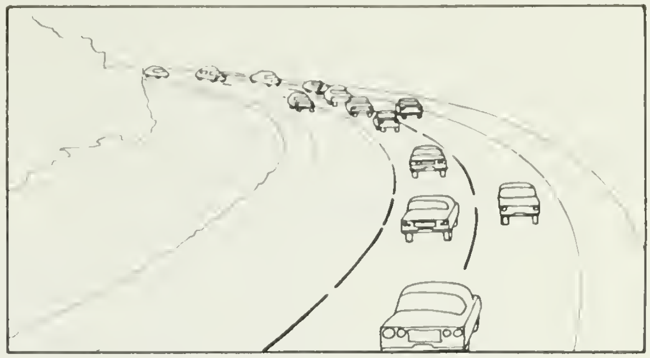
Highway Facilities

AM Peak. During the AM peak, northbound Artery/Expressway levels of service (LOS) are typically E or F from the Columbia Road on-ramp to the Charlestown High-Level Bridge, with v/c ratios ranging from 0.88 to 1.10. Several links experience LOS E or F operation because of excessive weaving, merging, or diverging conflicts at connecting ramps. Numerous on- and off-ramps along this length experience LOS E or F either because ramp volumes equal or exceed ramp capacities, or merging or weaving conflicts are excessive. Northbound operating speeds during the AM peak are typically less than 35 mph on the downtown portion of the Central Artery because of the numerous isolated congestion points previously mentioned. Northbound delays are common south of the on-ramp from the Massachusetts Turnpike.

Southbound during the AM peak,

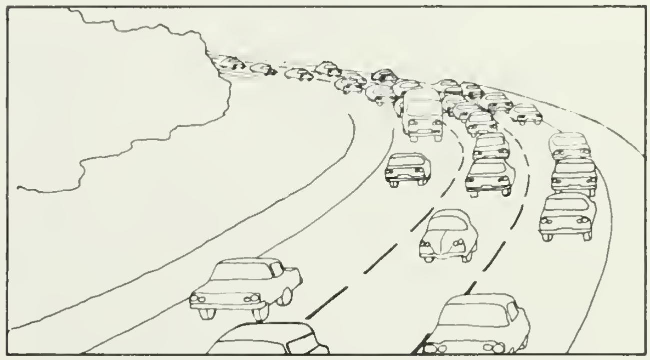


Level of Service A: Traffic is free flowing without physical restrictions on speed or maneuverability.

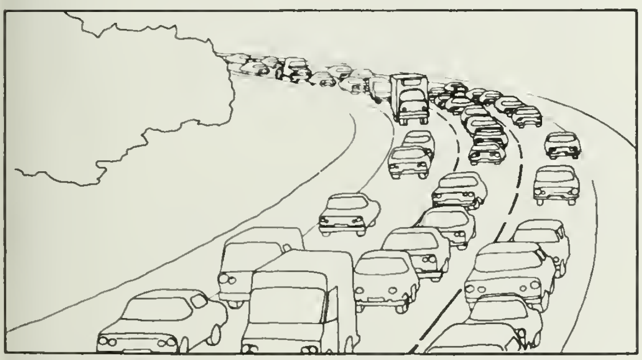


Level of Service B: Traffic moves in a stable flow with slight delays. The driver is reasonably free to choose lane and speed.

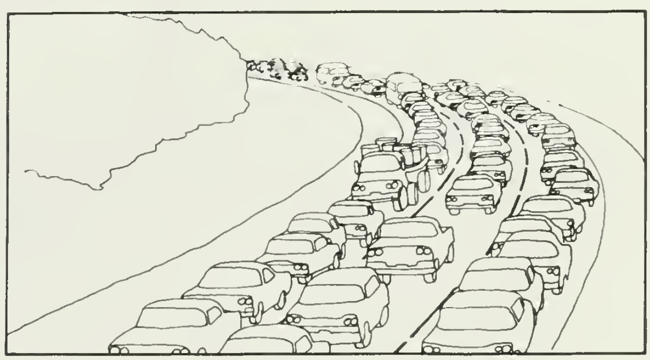
Level of Service C: Traffic volume controls speed and choice of lane, to a degree, but satisfactory movement is still maintained. Moderate delays are experienced.



Level of Service D: Traffic volume affects the maintenance of speed and choice of lane, causing congested, unstable flow.



Level of Service E: Traffic moves in an unstable flow with low speeds, increased congestion, and delays. Traffic volumes are at or near capacity.



Level of Service F: Forced flow conditions (stop and go). Traffic moves at very low speeds, if at all, resulting in significant congestion.

Figure 10

Pictorial Representation of Level of Service

Source: The Transportation Research Board, Washington, D.C.

LOS E or F operation is experienced from Interstate Route 93 and the Mystic-Tobin Bridge generally south through the Dewey Square Tunnel. A v/c ratio of 1.20 was calculated for the Charlestown High-Level Bridge, which in turn is responsible for extensive queues along Interstate Route 93 toward Sullivan Square in Charlestown and also on the Mystic-Tobin Bridge. Levels of service D or better are not realized until south of the Kneeland Street on ramp. Southbound operating speeds during the AM peak range from 20-35 mph on the Artery, due to the numerous congestion points.

LOS F conditions exist in the Sumner Tunnel during the morning peak, with a computed v/c ratio of 1.17. Although an adequate number of toll booths (seven) exist to serve current demand volumes, the entrance to the tunnel is severely congested because of the constricted merge from seven toll booth lanes into two lanes within only a 200-foot distance. Queues which originate on the Boston end of the tunnel because of poor geometry, pedestrian conflicts, and double parking on Cross Street often extend through the complete length of the tunnel and along Route 1A as far as the Airport Road interchange.

Inbound AM peak traffic on Route 1A is freeflowing until the Sumner Tunnel queue is reached. Outbound, in the Callahan Tunnel, AM peak traffic flow is normally within the range of LOS D. AM peak operating speeds in the Sumner Tunnel are typically less than 20 mph; corresponding speeds in the Callahan Tunnel range from 30-40 mph.

PM Peak. During the PM peak, levels of service on the northbound Expressway/Artery are typically F from the Massachusetts Avenue interchange through the Charlestown High-Level Bridge. These levels are mostly caused by the High-Level Bridge bottleneck, which will be discussed further in a later section. Compounding the effects of this bottleneck are several congestion points which also impede northbound traffic flow, including the Massachusetts Turnpike off-ramp, Atlantic Avenue off and on-ramps, the Callahan Tunnel off-ramp, and the Sumner Tunnel on-ramp. These isolated congestion points, and particularly the High-Level Bridge bottleneck, normally result in operating speeds less than 15 mph.

During the PM peak, the Artery/Expressway southbound operates at LOS E or F between the High-Level Bridge and the Southampton Street off-ramp, due primarily to restrictive speed conditions caused by constrictions. These constrictions include the Artery itself; the High-Level Bridge weaving section; the Storrow Drive on-ramp; the Causeway Street on-ramp and the Callahan Tunnel off-ramp weaving section; the Haymarket Square on-ramp; the Massachusetts Turnpike/Albany Street off-ramp; the Albany Street on-ramp; the weaving section between the Albany Street on-ramp and the Massachusetts Avenue off-ramp; and the reduction in capacity from four lanes to three lanes on the viaduct at the Massachusetts Avenue interchange. The Columbia Road on-ramp presently carries traffic volumes which exceed the ramp's capacity, resulting in LOS F operation on the ramp and significant merging conflicts on the Expressway. Operating speeds of about 20 to 30 mph prevail from the High-Level Bridge to the Columbia Road interchange.

LOS F operations exist in both the Sumner and Callahan Tunnels during the PM peak. As in the AM peak, merging conflicts at the entrance to the Sumner Tunnel and queues which originate at the Boston end of the Sumner Tunnel because of conflicts with pedestrians and local street traffic create backups as far as the Airport Road/Route 1A interchange. Callahan Tunnel traffic experiences long queues and delays at the Boston entrance; eight approach lanes from the northbound Central Artery, Surface Artery and North Street are squeezed into two tunnel lanes in less than 300 feet. Queues on the Central Artery off-ramp nearly reach the Artery,

TABLE 2

PEAK HOUR TRAFFIC VOLUMES, VOLUME-TO-CAPACITY (V/C) RATIOS, OPERATING SPEED (SP), & LEVELS OF SERVICE (LOS)
1982, 1990, 2010

Link / Ramp	Existing 1982 AM	Existing 1982 PM	Future No Build Alternative 1, 1990 AM	Future No Build Alternative 1, 1990 PM	Future No Build Alternative 1, 2010 AM	Future No Build Alternative 1, 2010 PM
MAJOR HIGHWAY LINKS - NORTHBOUND						
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	7450 (8%)	4350 (8%)	8780 (8%)	6030 (8%)	9650 (8%)	6590 (8%)
L2N. Frontage Road: Adjacent to Mass. Ave. Interchange	2580 (7)	1700 (7)	2770 (8)	1630 (8)	2810 (8)	1550 (8)
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	5780 (7)	3920 (8)	7940 (8)	5850 (8)	9420 (8)	6360 (8)
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	6450 (8)	4200 (8)	7410 (8)	5620 (8)	9500 (8)	5550 (8)
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	5030 (8)	4080 (8)	5740 (8)	5740 (8)	6420 (8)	6030 (8)
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	5540 (8)	4700 (8)	6000 (8)	5810 (8)	7220 (8)	6070 (8)
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	3660 (9)	5350 (8)	3570 (8)	*	4790 (8)	*
L8N. Mystic Tobin Bridge: North of I-93 Ramps	1580 (9)	3120 (9)	1900 (8)	3400 (8)	2010 (8)	3590 (8)
L9N. I-93: North of Tobin Bridge Ramps	2000 (8)	4290 (8)	2240 (8)	4290 (8)	2740 (8)	4400 (8)
L10N. Callahan Tunnel	2300 (3)	2850 (2)	2660 (3)	3740 (2)	3150 (3)	4070 (2)
L11N. Route 1A: Btwn. Toll Plaza and Airport Off-Ramp	2050 (3)	2580 (2)	2470 (3)	3330 (2)	2890 (3)	3590 (2)
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	930 (3)	2230 (2)	1220 (3)	2440 (4)	1330 (3)	2700 (5)
MAJOR HIGHWAY LINKS - SOUTHBOUND						
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	3370 (8)	5350 (8)	5130 (8)	8290 (8)	5660 (8)	8770 (8)
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	3920 (8)	6150 (8)	5700 (8)	9360 (8)	6190 (8)	10430 (8)
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	4540 (8)	5750 (7)	5170 (8)	8360 (8)	5400 (8)	8700 (8)
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	4350 (8)	4570 (8)	5620 (8)	8070 (8)	6160 (8)	8330 (8)
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	4730 (8)	4500 (8)	5430 (8)	6550 (8)	5700 (8)	6880 (8)
L6S. Central Artery: Btwn. Purchase On - and Dewey Sq. Off-Ramps	5050 (8)	3880 (7)	5590 (8)	5960 (8)	5850 (8)	6140 (8)
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	5850 (8)	3530 (5)	5740 (8)	5220 (8)	6190 (8)	5400 (8)
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	5570 (8)	3350 (8)	5470 (8)	4850 (8)	6080 (8)	5180 (8)
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	5220 (7)	2740 (9)	5170 (8)	4140 (8)	6190 (8)	4180 (8)
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	5430 (8)	3710 (9)	4790 (8)	4030 (8)	6190 (8)	4000 (8)
L11S. Mystic Tobin Bridge: North of I-93 Ramps	3060 (9)	2180 (9)	3340 (8)	2220 (8)	3720 (8)	2480 (8)
L12S. I-93: North of Tobin Bridge Ramps	3980 (8)	2150 (8)	3460 (8)	2850 (8)	4030 (8)	3000 (8)
L13S. Sumner Tunnel	3160 (4)	2640 (3)	3460 (3)	2810 (2)	3690 (3)	3260 (2)
L14S. Route 1A: Btwn. Airport On-Ramp and Toll Plaza	1510 (3)	1930 (2)	1630 (3)	1780 (2)	1750 (3)	2070 (2)
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	1750 (4)	1620 (2)	1440 (3)	1040 (4)	1440 (3)	1150 (5)
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND						
L1E. Mass. Turnpike, Eastbound: West of Expressway Ramps	4400 (9)	2080 (9)	4830 (8)	2520 (8)	4860 (8)	2920 (8)
L1W. Mass. Turnpike, Westbound: West of Expressway Ramps	1450 (9)	3180 (9)	2550 (8)	3400 (8)	2700 (8)	3660 (8)
L2E. Storrow Drive, Eastbound: West of Copley Sq. Ramps	3450 (0)	2600 (0)	3460 (0)	3000 (0)	3990 (0)	3110 (0)
L2W. Storrow Drive, Westbound: West of Copley Sq. Ramps	2430 (0)	3440 (0)	3340 (0)	3960 (0)	3880 (0)	4030 (0)
MAJOR HIGHWAY RAMPS - NORTHBOUND						
R1N. Columbia Road Off; from S.E. Expressway	500	260	570	*	680	330
R2N. Mass. Avenue On; to S.E. Expressway	460	200	1520	700	2010	700
R3N. Mass. Turnpike On; to Central Artery	1600	700	1750	700	2320	630
R4N. Atlantic Avenue Off; from Central Artery	2360	1540	3840	2110	4940	1700
R5N. Atlantic Avenue On; to Central Artery	220	800	840	1000	800	1150
R6N. Callahan Tunnel Off; from Central Artery	1330	730	1250	1410	1330	1550
R7N. Sumner Tunnel On; to Central Artery	1420	1350	1560	1520	2130	1590
R8N. Storrow Drive Off; from Central Artery	1900	1100	1820	1630	2470	1670
R9N. Storrow Drive On; to Central Artery	1200	2000	*	*	*	*
R10N. Airport Off; from Route 1A	1390	1270	1710	1850	2130	2110
R11N. Airport On; to Route 1A	270	920	460	960	570	1220
MAJOR HIGHWAY RAMPS - SOUTHBOUND						
R1S. Columbia Road On; to S.E. Expressway	400	1900	*	*	*	*
R2S. Mass. Avenue Off; from S.E. Expressway	720	500	*	*	*	*
R3S. Albany Street On; to S.E. Expressway	600	1900	490	2290	490	1630
R4S. Mass. Tpk./Albany St. Off; from Central Artery	1260	1300	*	*	*	*
R5S. Dewey Square Off; from Central Artery	750	480	720	520	840	370
R6S. High Street Off; from Central Artery	1300	550	1100	560	1330	520
R7S. Haymarket On; to Central Artery	1560	1890	1750	1740	2050	1670
R8S. Callahan Tunnel Off; from Central Artery	1280	1710	1520	1370	1940	1440
R9S. Storrow Drive On; to Central Artery	1500	850	2050	1150	2130	1180
R10S. Storrow Drive Off; from Central Artery	1720	1820	1630	*	2130	*
R11S. Airport Off; from Route 1A	770	530	870	670	1030	850
R12S. Airport On: to Route 1A	530	850	1060	1400	1330	1780

Link / Ramp	Existing 1982 AM V/C	SP	LOS	Existing 1982 PM V/C	SP	LOS	1990 AM V/C	SP	LOS	1990 PM V/C	SP	LOS	2010 AM V/C	SP	LOS	2010 PM V/C	SP	LOS
MAJOR HIGHWAY LINKS - NORTHBOUND																		
L1N.	1.03	30	F	0.60	40	C	1.22	25	F	0.83	35	E	1.34	20	F	0.91	35	E
L2N.	0.69	30	D	0.46	40	B	0.74	25	D	0.44	40	B	0.76	25	D	0.42	40	B
L3N.	1.10	30	F	0.75	30	F	1.10	30	F	0.81	30	F	1.31	20	F	0.88	25	F
L4N.	1.13	20	F	0.75	15	F	1.29	15	F	1.01	15	F	1.62	10	F	1.00	15	F
L5N.	0.96	30	F	0.78	15	F	1.06	25	F	1.06	15	F	1.19	20	F	1.11	15	F
L6N.	0.90	35	E	0.79	15	F	1.06	25	F	0.99	15	F	1.24	20	F	1.00	15	F
L7N.	0.89	25	F	1.30	15	F	0.68	40	C	*			0.91	30	E	*		
L8N.	0.40	50	A	0.78	45	C	0.48	45	A	0.85	40	D	0.50	45	A	0.90	35	E
L9N.	0.28	50	A	0.59	50	C	0.31	50	A	0.59	50	C	0.38	50	A	0.61	50	C
L10N.	0.85	35	D	1.06	20	F	0.99	30	E	1.39	20	F	1.17	20	F	1.51	15	F
L11N.	0.36	35	C	0.45	30	C	0.44	30	C	0.58	20	C	0.51	25	C	0.63	20	C
L12N.	0.17	45	A	0.39	45	A	0.22	45	A	0.43	40	B	0.24	45	A	0.47	40	B
MAJOR HIGHWAY LINKS - SOUTHBOUND																		
L1S.	0.62	50	B	0.74	30	F	0.71	40	D	1.15	30	F	0.78	40	D	1.22	30	F
L2S.	0.62	50	A	0.85	30	E	0.64	40	D	1.21	25	F	0.70	30	F	1.35	20	F
L3S.	0.73	35	D	0.95	20	F	0.60	45	B	1.13	20	F	0.63	40	C	1.17	20	F
L4S.	0.74	40	C	0.78	20	F	0.78	25	F	1.13	20	F	0.85	25	F	1.16	20	F
L5S.	0.78	35	E	0.75	20	F	0.90	25	F	1.10	15	F	0.91	20	F	1.12	15	F
L6S.	0.83	30	E	0.65	25	F	0.92	25	F	1.02	20	F	0.97	20	F	1.05	20	F
L7S.	1.08	30	F	0.64	25	F	1.05	25	F	0.94	25	F	1.14	20	F	0.98	25	F
L8S.	0.96	30	F	0.62	25	F	0.95	25	F	0.91	25	F	1.03	20	F	0.94	25	F
L9S.	0.96	30	E	0.51	25	F	0.96	25	E	0.77	25	F	1.14	20	F	0.77	25	F
L10S.	1.20	20	F	0.81	25	F	0.88	25	F	0.74	25	F	1.14	20	F	0.75	30	F
L11S.	1.13	10	F	0.81	30	F	0.84	40	D	0.56	45	C	0.93	35	E	0.46	45	C
L12S.	0.73	15	F	0.40	50	C	0.64	35	E	0.53	50	C	0.74	30	F	0.55	50	C
L13S.	1.17	20	F	0.98	20	F	1.28	20	F	1.04	20	F	1.37	20	F	1.21	20	F
L14S.	0.27	5	F	0.34	5	F	0.30	5	F	0.31	5	F	0.31	5	F	0.36	5	F
L15S.	0.31	45	A	0.28	45	A	0.26	45	A	0.18	45	A	0.26	45	A	0.20	45	A
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND																		
L1E.	0.80	40	D	0.37	45	C	0.87	30	E	0.45	45	C	0.88	30	E	0.52	45	C
L1W.	0.27	55	A	0.58	55	B	0.46	55	B	0.62	55	B	0.49	55	B	0.66	50	C
L2E.	0.59	40	C	0.45	40	C	0.59	40	C	0.51	40	C	0.69	40	C	0.53	40	C
L2W.	0.42	40	C	0.59	40	C	0.57	40	C	0.68	40	C	0.67	40	C	0.69	40	C
MAJOR HIGHWAY RAMPS - NORTHBOUND																		
R1N.	0.34	35	C	0.17	35	C	0.38	35	C	*			0.46	35	C	0.22	35	C
R2N.	0.30	35	D	0.13	40	B	0.99	30	F	0.46	35	D	1.31	30	F	0.46	35	D
R3N.	1.08	20	F	0.51	30	C	1.17	20	F	0.51	30	C	1.56	10	F	0.46	30	C
R4N.	1.58	15	F	1.03	20	F	>2.00	10	F	1.40	15	F	>2.00	5	F	1.13	20	F
R5N.	0.16	25	F	0.53	15	F	0.61	25	F	0.66	15	F	0.59	20	F	0.76	15	F
R6N.	0.86	25	E	0.47	20	F	0.81	25	E	0.90	20	F	0.86	20	F	0.99	15	F
R7N.	0.91	30	E	0.87	30	E	1.00	15	F	0.98	15	F	1.37	10	F	0.98	15	F
R8N.	0.62	35	C	0.37	40	C	0.59	35	C	0.55	40	C	0.80	25	E	0.56	40	C
R9N.	0.78	30	E	1.37	10	F	*			*			*			*		
R10N.	0.87	30	E	0.79	30	E	1.07	25	F	1.14	25	F	1.33	20	F	1.30	20	F
R11N.	0.17	40	B	0.57	40	B	0.28	40	B	0.59	35	C	0.36	40	B	0.76	30	D
MAJOR HIGHWAY RAMPS - SOUTHBOUND																		
R1S.	0.27	35	C	1.28	25	F	*			*			*			*		
R2S.	0.23	40	B	0.16	45	A	*			*			*			*		
R3S.	0.40	30	C	1.25	20	F	0.33	30	C	1.51	20	F	0.33	30	C	1.07	20	F
R4S.	0.85	25	E	0.88	25	E	*			*			*			*		
R5S.	0.50	30	C	0.32	35	C	0.49	30	C	0.34	35	C	0.56	30	C	0.25	35	C
R6S.	0.87	20	E	0.36	30	C	0.74	20	E	0.36	30	C	0.89	20	E	0.34	30	C
R7S.	1.01	15	F	1.20	15	F	1.13	15	F	1.12	15	F	1.32	10	F	1.06	15	F
R8S.	0.41	15	F	0.57	15	F	0.49	15	F	0.46	15	F	0.62	15	F	0.48	15	F
R9S.	0.98	20	F	0.57	30	C	1.34	20	F	0.75	25	E	1.39	20	F	0.77	25	E
R10S.	1.12	20	F	1.22	20	F	1.06	20	F	*			1.39	20	F	*		
R11S.	0.47	35	B	0.33	40	A	0.54	30	C	0.42	35	B	0.63	30	C	0.53	30	C
R12S.	0.34	30	C	0. 5	25	F	0.69	30	C	0.91	20	F	0.87	25	E	1.17	15	F

(0%) = Percent Trucks

* = Inconsistent Data

TABLE 2 (CONTINUED)
PEAK HOUR TRAFFIC VOLUMES,
VOLUME-TO-CAPACITY (V/C) RATIOS,
OPERATING SPEED (SP), &
LEVELS OF SERVICE (LOS)
1982, 1990, 2010

	EXISTING 1982		FUTURE NO BUILD ALTERNATIVE 1 1990		2010		EXISTING 1982 AM			PM			FUTURE NO BUILD ALTERNATIVE 1 1990 AM			PM			2010 AM			PM		
	AM	PM	AM	PM	AM	PM	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS
INTERSECTIONS																								
South Boston																								
1. Columbia Circle	5260 (1%)	4340 (1%)	6150	5030	6200	5710	0.85		D	0.52		A	0.95		E	0.65		B	0.95		E	0.76		C
2. Andrew Square**	2000 (14)	1650 (8)	3070	2980	3160	3210	1.02		F	0.84		D	1.63		F	1.53		F	1.65		F	1.63		F
3. Columbia Rd./Day Blvd./L St.	1390 (1)	1450 (1)	1370	1480	1370	1530	0.25		C	1.05		F	>2.00		F	1.27		F	>2.00		F	1.39		F
4. L St./East First St./Summar St.**	1500 (6)	1550 (5)	1890	1810	1910	1860	0.86		D	0.76		C	0.92		E	0.86		D	0.93		E	0.90		D
5. Dorchaster Ave./W. 5th St./A St.**	2300 (5)	2140 (5)	2410	2200	2440	2550	0.53		A	0.65		B	0.55		A	0.69		B	0.56		A	0.81		D
6. Dorchester Ave./W. 4th St.**	2230 (6)	2060 (7)	2390	2100	2450	2310	0.58		A	0.50		A	0.50		A	0.52		A	0.52		A	0.58		A
7. Dorchester Ava./W. Broadway**	2650 (9)	2750 (7)	2690	*	2790	*	0.87		D	1.07		F	0.92		E	*			0.96		E	*		
8. Summar St./Dorchester Ava.**	2650 (10)	2400 (6)	3120	4060	3140	4080	0.78		C	0.76		C	0.99		E	1.46		F	0.99		E	1.44		F
9. Summer St./Melchar St.**	2340 (7)	2040 (4)	2800	2960	2770	3040	0.44		A	0.48		A	0.53		A	0.69		B	0.53		A	0.67		B
10. Summar St./D St.**	2380 (9)	2220 (6)	2610	2570	2410	2600	0.73		C	0.69		B	0.78		C	0.75		C	0.60		B	0.76		C
11. Congrass St./Dorchester Ave.	2020 (8)	1730 (6)	2300	3390	*	3540	2.00		F	>2.00		F	>2.00		F	>2.00		F	*			>2.00		F
12. Congress St./A St.	950 (11)	1080 (5)	1240	2010	1240	2150	0.88		E	1.25		F	1.47		F	>2.00		F	1.47		F	>2.00		F
13. Northern Ave./Slaeper St.	1270 (12)	1730 (3)	2660	2370	2690	2410	1.30		F	>2.00		F	>2.00		F	>2.00		F	1.91		F	>2.00		F
14. Harald St./Broadway/Frontaga Rd./Albany St.**	3670 (9)	4140 (6)	4910	4330	4960	5000	0.84		D	0.80		C	1.07		F	0.90		E	1.13		F	0.94		E
15. Barkaley St./W. Fourth St./Frontaga Rd./Albany St.**	4530 (8)	4410 (6)	5910	6440	6090	5700	1.03		F	0.76		C	1.07		F	0.77		C	1.11		F	0.80		C
East Boaton and Revara																								
16. Sumner St./Maridian St./Chelsea St.**	620 (10)	720 (5)	690	880	690	890	0.26		A	0.34		A	0.44		A	0.46		A	0.44		A	0.46		A
17. Sumner St./Bremen St.	460 (7)	550 (4)	520	550	460	550	0.08		B	0.12		B	0.22		B	0.12		B	0.14		B	0.12		B
18. Maverick St./Meridian St./Chalsea St.	880 (8)	990 (4)	830	1030	830	1060	0.52		C	0.44		B	0.52		C	0.63		D	0.51		C	0.69		D
19. Mavarick St./Bremen St.	480 (5)	510 (3)	480	540	480	540	0.21		A	0.15		A	0.20		A	0.17		B	0.20		A	0.17		B
20. Maverick St./Jeffries St./Airport Access Rd.	380 (6)	320 (8)	380	320	380	320	0.26		A	0.15		A	0.26		A	0.14		A	0.26		A	0.14		A
21. Porter St./Chelsea St./Visconti Rd.**	1560 (6)	1500 (3)	2120	1850	2430	2170	0.83		D	0.65		B	0.93		E	0.88		D	1.27		F	1.01		F
22. Portar St./Bramen St.	980 (4)	1290 (2)	1000	1320	1220	1510	0.52		D	0.75		E	0.94		E	0.73		E	1.09		F	1.04		F
23. Porter St./Orlaane St.	570 (5)	790 (2)	820	880	1020	1030	0.11		A	0.22		C	0.27		D	0.20		C	0.27		D	0.28		D
24. Porter St./Cottage St.	540 (6)	670 (2)	770	810	990	970	0.34		A	0.32		A	0.49		A	0.52		A	0.64		B	0.62		B
25. Cantral Square (Meridian St./Saratoga St.)**	1000 (7)	1040 (4)	1170	1210	1260	1230	0.42		A	0.36		A	0.46		A	0.44		A	0.57		A	0.54		A
26. Porter St./London St.	850 (4)	670 (5)	930	840	1060	990	1.05		F	0.37		C	1.22		F	0.60		D	1.30		F	0.99		E
27. Bennington St./Prescott St.	1150 (5)	930 (4)		NO DATA AVAILABLE			0.23		D	0.14		D				NO DATA AVAILABLE								
28. Chelsea St./East Eagle St.	1070 (5)	1190 (5)	910	940	1020	1130	0.18		C	0.26		C	0.22		D	0.12		A	0.28		D	0.14		A
29. Bannington St./Neptune Rd.	2370 (6)	1890 (6)		NO DATA AVAILABLE			0.68		B	0.62		B				NO DATA AVAILABLE								
30. McClellan Off-Ramp/Neptuna Rd.	920 (6)	1460 (4)	1000	1330	1140	1460	0.55		C	1.27		F	0.38		C	1.04		F	0.65		D	0.96		F
31. Condor St./Meridian St.**	1070 (6)	1330 (3)	1300	1330	1470	1630	0.42		A	0.51		A	0.41		A	0.59		A	0.65		B	0.59		A
32. Airport Crossover Roads**	3630 (3)	4860 (4)	5380	6390	6640	7870	0.64		B	0.95		E	0.77		C	0.81		D	0.94		E	0.99		E
33. Ball Circle (Ravere)**	3860 (7)	4470 (4)	4760	5150	4870	5420	1.15		F	0.89		D	1.33		F	1.18		F	1.37		F	1.24		F
Downtown																								
34. Kneeland St./Surface Artary/S.B. On-Ramp**	2550 (9)	3240 (13)	3650	4010	3370	3990	0.69		B	0.86		D	1.04		F	0.71		C	0.97		E	0.90		E
35. Dewey Sq.**	3770 (8)	4890 (6)	*	*	5870	6280	0.64		F	0.73		F	*			*			1.94		F	1.77		F
36. Atlantic Ava./Congress St.**	3040 (6)	2740 (6)	*	*	4490	4790	0.94		E	0.85		D	*			*			1.36		F	1.33		F
37. Atlantic Ave./Northarn Ave.	2440 (7)	3560 (5)	*	*	4740	4440	2.00		F	>2.00		F	*			*			>2.00		F	>2.00		F
38. Atlantic Ave./Surface Artery/High St.**	3220 (7)	3420 (6)	5700	4220	6230	4070	0.89		D	0.80		C	1.42		F	0.93		F	1.42		F	0.81		F
39. Purchase St./Congress St.**	2250 (7)	2970 (7)	2400	2960	2620	3140	0.65		B	0.82		D	0.64		B	0.72		C	0.68		B	0.77		D
40. North St./Blackstona St./S.B. Off-Ramp	2710 (4)	3540 (4)	4040	4000	4580	4400	2.00		F	>2.00		F	>2.00		F	>2.00		F	>2.00		F	>2.00		F
41. Cross St./Hanover St./Salem St.	2070 (4)	2110 (2)	2840	2360	2680	2610	1.89		F	>2.00		F	>2.00		F	>2.00		F	>2.00		F	>2.00		F
42. Leverett Circle**	6720	6260	6860	6420	6560	6770	0.96		E	0.75		F	1.09		F	0.92		F	0.99		E	0.80		F

(0%) = Percent Trucks

* = Inconsistent Data

** = Signalized Intersection

NOTES: 1. V/C ratios and levels of service, at unsignalized intersections, indicate minor street operating conditions.

2. Intersection volumes are total approach volumes.

causing exiting traffic to slow, impeding traffic flow. Long queues also extend back along the Surface Artery and North Street.

Intersections and Local Streets

Intersections rather than roadway links usually control traffic flow on city and neighborhood streets, and are discussed below.

South Boston Intersections. Of the 15 key intersections in South Boston analyzed, five experience LOS E or F conditions during the AM peak hour. These are: Andrew Square, because five of the six approaches to this signalized intersection are one lane approaches carrying significant traffic volumes; Congress Street/ Dorchester Avenue, because of significant delays to Dorchester Avenue traffic while waiting for gaps in Congress Street traffic; Congress Street/A Street, with significant delay to A Street traffic; Northern Avenue/Sleeper Street, with Sleeper Street experiencing delays due to a high volume of traffic on Northern Avenue; and Berkeley Street/West Fourth Street/Frontage Road/Albany Street, due to substantial volumes of traffic, particularly on Frontage Road.

Five intersections also operate at LOS F during the PM peak hour. These are Columbia Road/Day Boulevard/ L Street, because of substantial volumes of through traffic traveling southbound on L Street attempting to bypass Central Artery congestion; Dorchester Avenue/West Broadway, because of heavy traffic volumes on the Broadway Bridge and southbound Dorchester Avenue approaches; the Congress Street intersections with Dorchester Avenue and A Street; and Northern Avenue/Sleeper Street.

East Boston Intersections. During both peak hours, most of the key intersections in East Boston presently operate at, or better than, LOS D. Porter Street/London Street operates at LOS F during the AM peak hour, reflecting the delays to London Street traffic resulting from heavy traffic volumes on Porter Street, the lack of traffic signal control, and queues from the Sumner Tunnel.

During the PM peak hour, only the McClellan Highway (Route 1A) off-ramp/Neptune Road intersection operates at LOS F. This is attributable to a significant volume of airport traffic destined to the Sumner Tunnel which backtracks by traveling on Route 1A northbound to Neptune Road, then follows neighborhood streets, to gain access to the tunnel. Two intersections, the airport access/egress roads with the Airport Crossover Road, and Porter/Bremen Streets, operate at LOS E (capacity).

Bell Circle, Revere. Bell Circle in Revere operates at LOS F during the AM peak, due to heavy inbound volumes from Routes 1A and 60. Although PM peak hour volumes are greater, geometry, traffic signal phasing and timing, and the predominant outbound flow enable Bell Circle to operate at LOS D during the PM peak hour.

Downtown Boston Intersections. In the downtown area, six of nine key intersections operate at LOS E or F during the AM peak hour due primarily to heavy volumes of traffic: Atlantic Avenue/Congress Street; Atlantic Avenue/Northern Avenue; North Street/ Blackstone Street/Southbound Artery Off-Ramp; Cross Street/Hanover Street/Salem Street.

Leverett Circle operates at LOS E during the AM peak. Charles Street and Charles River Dam Road traffic volumes are substantial. Dewey Square, which actually consists of four distinct intersections -- Atlantic Avenue/Summer Street; Surface Road/Summer Street/Purchase Street; High Street/Summer Street/South Street; and Surface Road/South Street -- operates at LOS F during the AM peak because of substantial pedestrian volumes exiting South Station and crossing Atlantic Avenue and Summer Street in large platoons, occupying travel lanes after the traffic signal's pedestrian interval has

terminated.

During the PM peak hour, the intersections of Atlantic Avenue/Northern Avenue, North Street/Blackstone Street/Southbound Artery Off-Ramp, and Cross Street/Hanover Street/Salem Street operate at LOS F, as in the AM peak hour. Leverett Circle functions at LOS F due to Central Artery on-ramp traffic backing up through the intersection. Similarly, Dewey Square functions at LOS F due to substantial pedestrian volumes, double-parking, and passenger pick-ups in front of South Station.

Existing Central Artery Bottlenecks and Congestion Points

In the northbound Central Artery direction, the low speeds and forced-flow conditions previously noted are specifically caused by the two-lane Artery bottleneck on the approach to the Charlestown High-Level Bridge, as well as at congestion points at several other Central Artery ramp junctions. (A "bottleneck", as defined here, is a point on a highway facility where a travel lane is dropped without the presence of an off-ramp. Queues also result at some ramp junctions which are referred to here as "congestion" points.)

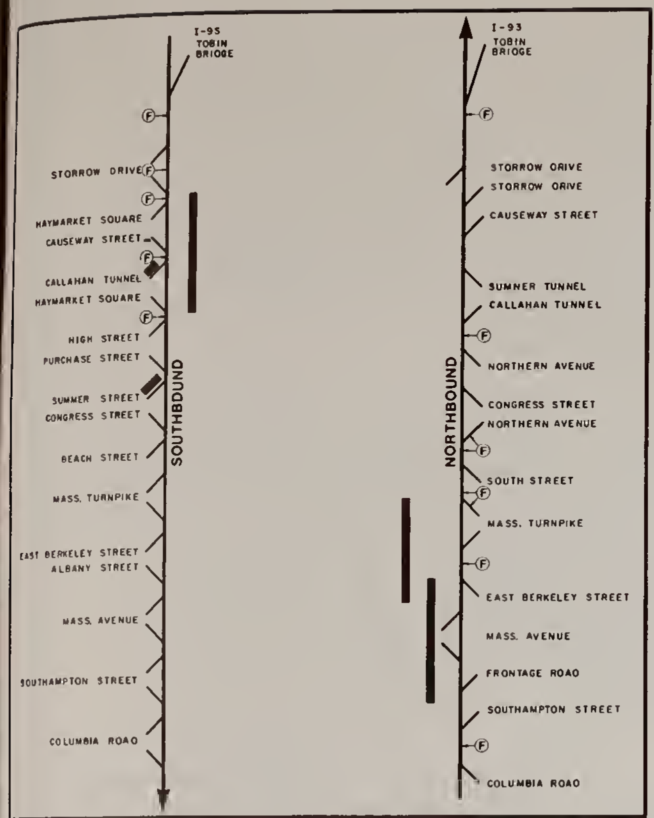
Figure 11 illustrates the extent of the northbound High-Level Bridge queue and also the extent of queue lengths resulting from off-ramp junctions which serve as congestion points. Each queue length shown in Figure 11 reflects each bottleneck's/congestion point's separate or isolated contribution to total queuing on the Central Artery; it does not represent the cumulative effect of all queues combined (i.e., the queues are not additive), which often extend the full length of the Artery and portions of the Southeast Expressway in one or both directions during existing peak hours. These queues have been isolated to identify each contributing Artery bottleneck and congestion point; the magnitutde of its separate contribution to total queuing on the Artery; and the effectiveness of each Third Harbor Tunnel alternative in reducing or eliminating each separate queue's contribution to total Central Artery congestion (see Section 4.2).

During the PM peak period, a queue length of nearly two miles, extending from the High-Level Bridge bottleneck to past the East Berkeley Street on-ramp is typical in the northbound direction. The speed of this queue is estimated at seven miles per hour, resulting in an average delay per vehicle of nearly 15 minutes over this length of roadway.

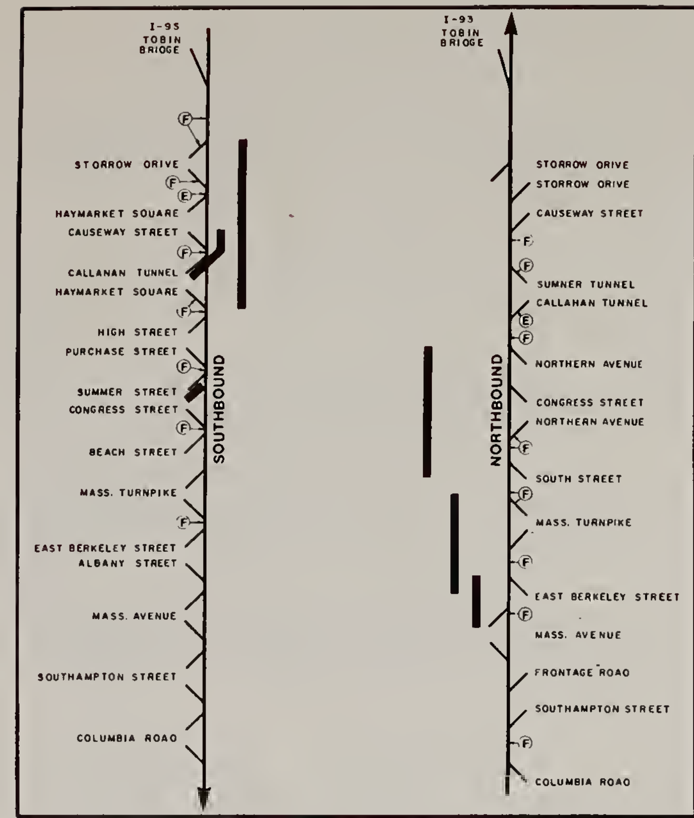
In the southbound direction during the PM peak, four isolated congestion points exist. The first occurs at the southbound Callahan Tunnel ramp/North Street/Blackstone Street intersection, extending back beyond the Causeway Street on-ramp. Further south, queuing from the Haymarket Square on-ramp merge area extends nearly to the Callahan Tunnel diverge area. A third congestion point, at the Albany Street on-ramp, typically backs up into the Dewey Square Tunnel. Finally, the merge of Columbia Road on-ramp traffic with the Southeast Expressway typically creates a queue extending beyond Southampton Street.

In the morning peak, major queuing occurs at two congestion points along the northbound Central Artery. The East Berkeley Street on-ramp creates a queue which typically extends nearly to Southampton Street. Secondly, a queue created at the Massachusetts Turnpike on-ramp extends nearly to the Massachusetts Avenue on-ramp. Southbound, a queue extends from the Haymarket on-ramp back to the Storrow Drive on-ramp. In addition, a queue of nearly two miles in length forms southbound along Interstate Route 93 north of the High-Level Bridge, while a similar queue 1.3 miles long forms on the Mystic-Tobin Bridge for inbound (southbound) traffic.

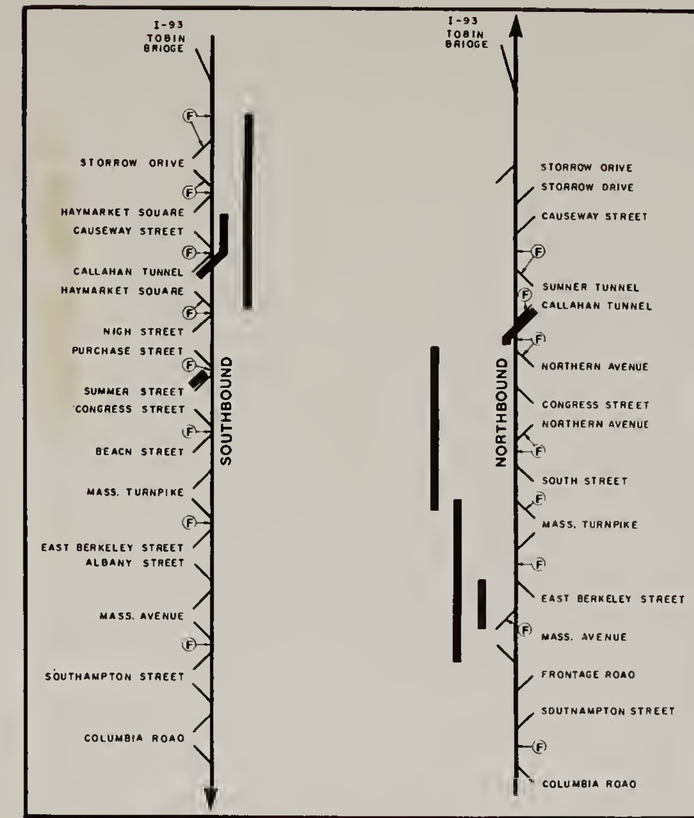
3.1.2 Future Roadway Characteristics Without The Project



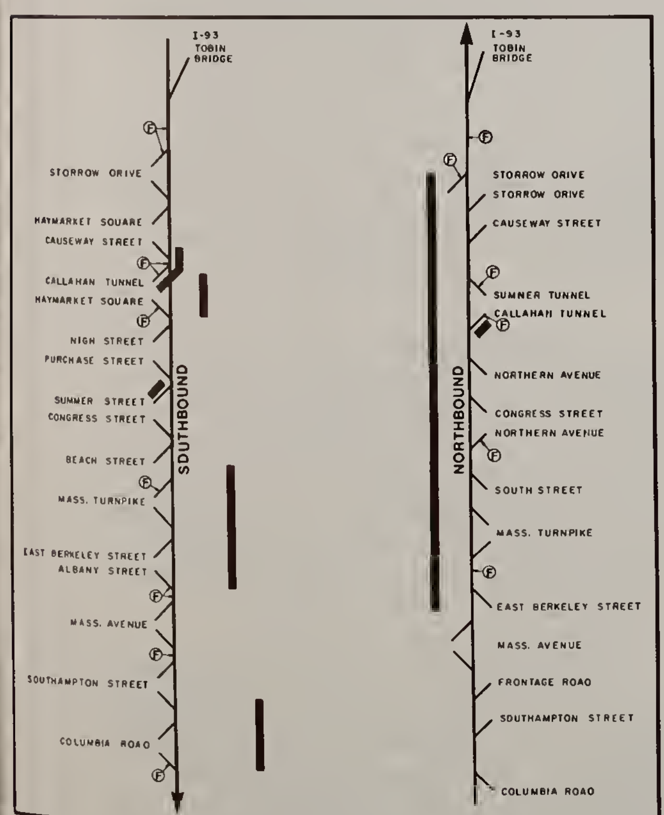
1982 A.M. PEAK HOUR



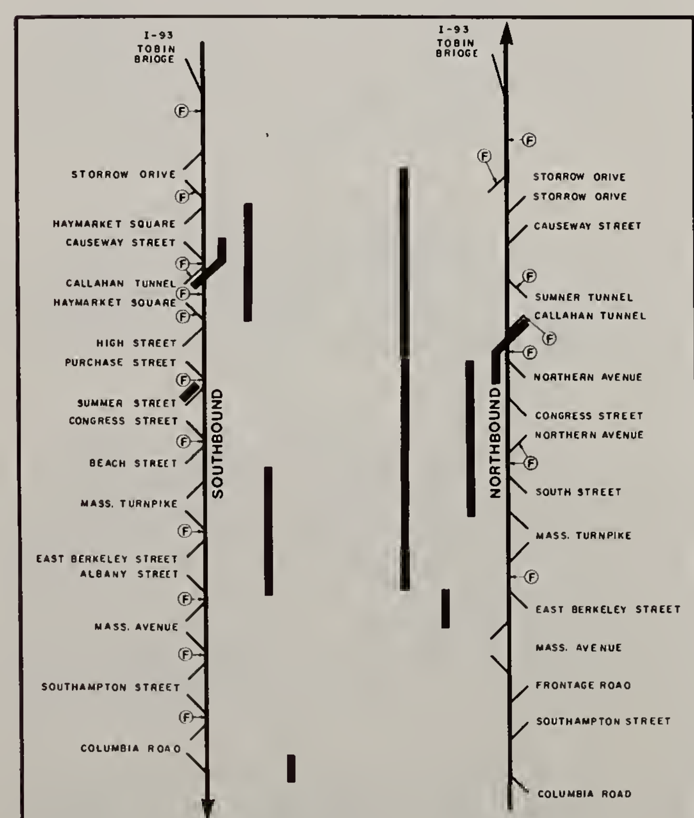
1990 A.M. PEAK HOUR



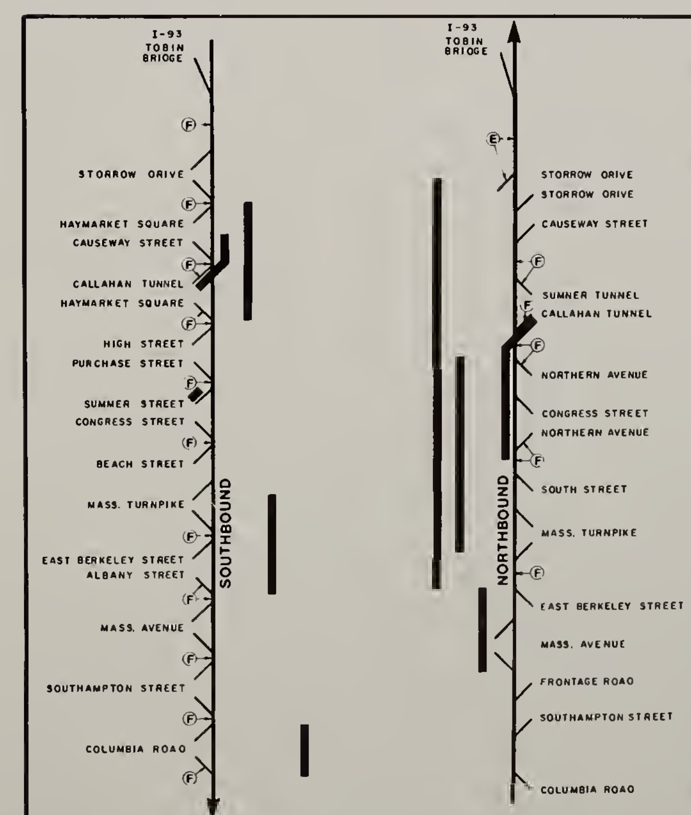
2010 A.M. PEAK HOUR



1982 P.M. PEAK HOUR



1990 P.M. PEAK HOUR



2010 P.M. PEAK HOUR

Figure 11
Alternative 1—Central Artery and Southeast Expressway, Congestion Points and Queues

Diagrams not to scale

EIS/EIR for I-90, The Third Harbor Tunnel

Legend
Typical Extent of Queue
Ⓕ Level of Service at Congestion Point

Future Roadway Network Changes

Several roadway construction projects are planned for the future which have been assumed to be completed by 1990. These include:

1. The Central Artery North Area Project.

2. Deck replacement on the central section of the Central Artery.

3. Southeast Expressway upgrading project, creating four lanes in each direction to the Dewey Square Tunnel.

4. The Seaport Access Road, which provides a direct connection between B Street and Northern Avenue in South Boston.

5. Street pattern changes associated with the proposed South Station Transportation Center.

6. Relocated Northern Avenue Bridge.

Future Traffic Volumes

AWDT Volumes. Table 1, previously presented, summarizes Average Weekday Daily Traffic (AWDT) volumes for the affected roadway network for 1990 and 2010 No-Build conditions.

Comparing the 1990 forecasts with existing (1982) volumes, little growth in traffic is anticipated on the three roadway facilities crossing Boston Harbor (approximately one to two percent).

Several roadways will experience more substantial traffic increases than the harbor crossings between 1982 and 1990: Interstate 93, north of the High-Level Bridge (14 percent); the Massachusetts Turnpike (12 percent); Route 1A (16 percent); and the airport access/egress roadways (20 percent).

Traffic on the Central Artery and Southeast Expressway will grow more modestly, with typically a two to four percent increase expected between 1982 and 1990. However, a nine percent increase has been forecast for the Central Artery, between Massachusetts Avenue and Albany Street, with much of the increase being traffic using the Massachusetts Avenue ramps. As for 1982, the largest AWDT volume predicted for 1990 on the Artery/Expressway is south of the Callahan/Sumner Tunnels.

In East Boston, Maverick Street, Sumner Street, and Bennington Street will increase less than five percent between 1982 and 1990. Porter Street and airport access/egress road traffic, however, will increase 19 to 20 percent for that same period, reflecting increased airport-related trips. Meridian Street traffic is expected to increase by 17 percent.

In South Boston, Columbia Road, L Street, D Street, and Dorchester Avenue, all of which function as relief valves for Expressway/Artery congestion, are expected to experience increases over the eight-year period ranging from less than 10 percent on Dorchester Avenue to more than 50 percent on D Street. Increases varying from 31 percent to 68 percent are predicted by 1990 for the three bridges crossing the Fort Point Channel, indicating that traffic will continue to bypass the congested Southeast Expressway/Central Artery in the future, and also reflecting increased land development in the northern section of South Boston.

Truck composition on the major highways of the affected roadway network in 1990 is expected to be similar to that of 1982, with the exception of D Street in South Boston, which is estimated to carry increased truck volumes (from 8 to 13 percent), due to the increased development in the northern industrial area.

Comparing 2010 AWDT forecasts to those of 1982, traffic volume will continue to increase on major highway facilities, as shown in Table 1. Cross-harbor traffic volumes will increase by approximately 9 and 11 percent over existing conditions on

the Mystic-Tobin Bridge and in the Callahan/Sumner Tunnels, respectively. Volumes on Interstate 93 north of the High-Level Bridge are expected to increase by close to 19 percent, while traffic on the Massachusetts Turnpike Extension will increase by approximately 13 percent during this period. Due to capacity constraints, modest increases in traffic are expected on the Central Artery and Southeast Expressway (4 to 10 percent), while Route 1A and the airport access/egress roadways are expected to continue to experience significant increases in traffic, due to expected airport growth, 30 and 48 percent respectively, over existing traffic volumes. An AWDT volume of 173,400 vehicles is predicted on the Central Artery between the Callahan/Sumner Tunnels and High Street.

In East Boston, traffic is expected to increase by 39 percent on Porter Street from 1982 to 2010, while Maverick and Sumner Streets traffic will increase by about 12 percent. In South Boston, Columbia Road, L Street, D Street, and Dorchester Avenue traffic will continue to increase to year 2010, although not as rapidly as from 1982 to 1990.

Truck composition in year 2010 is expected to be similar to that of 1990, with no significant increases or decreases anticipated in the percentage of trucks.

Peak Hour Volumes. Year 1990 and 2010 AM and PM peak hour traffic forecasts under No-Build conditions are also summarized in Table 2. Central Artery/Expressway peak hour traffic will increase by up to 77 percent from 1982 to 1990 on some directional links south of the Dewey Square tunnel, where capacity will be increased as a result of the Southeast Expressway upgrading project. Increases ranging between 8 and 46 percent are predicted between 1982 and 1990 for directional links north of Dewey Square.

A 16 percent increase in AM peak hour traffic between 1982 and 1990 is predicted for the Callahan Tunnel. During the PM peak hour, a 31 percent increase is forecast. In the Sumner Tunnel, a 9 percent increase is predicted for the AM peak hour and a 6 percent increase for the PM peak hour.

From 1990 to 2010, growth in traffic will not be as rapid as between 1982 and 1990. This trend is maintained on most of the highway links on the affected roadway network.

Future V/C Ratios and Levels of Service

Highway Facilities

Future (1990, 2010) No-Build v/c ratios and levels of service were previously presented in Table 2.

AM Peak. In 1990, AM peak hour levels of service on the northbound Central Artery will typically be E or F from Columbia Road to the Storrow Drive on-ramps, indicating essentially no change over existing levels of service, but increased congestion and delays resulting in extended peak periods, as evidenced by higher 1990 v/c ratios. Traffic flow on the High-Level Bridge will improve (to LOS C) because of the proposed Central Artery North Area Project, which will increase the weaving distance between Storrow Drive and the Mystic-Tobin Bridge connections. As is the case today, most on- and off-ramp junctions with the Central Artery will experience LOS E or F operation in 1990, either because ramp volumes equal or exceed ramp capacity, or because merging or weaving conflicts are excessive.

Southbound, under 1990 AM peak hour conditions, forced flow (LOS F) operation will prevail from Interstate 93 and the Mystic-Tobin Bridge south to the Albany Street on-ramp; v/c ratios will range from 0.78 to 1.05. The Southeast Expressway, between the Albany Street on-ramp and the Massachusetts Avenue off-ramp, will operate at LOS B (v/c = 0.60) due to the Southeast Expressway upgrading project.

Traffic flow in the Sumner

Tunnel will continue to be congested (LOS F) in year 1990, with an AM peak hour v/c ratio of 1.28. Toll booth capacities will be exceeded. Outbound, traffic level of service in the Callahan Tunnel will remain within the LOS D range in spite of the 14 percent increase in traffic predicted for 1990 AM peak conditions.

By 2010, northbound Central Artery traffic conditions during the morning peak will become more congested with continued traffic growth. Volumes at many key links and ramps will far exceed their theoretical capacities, with forced flow conditions prevailing from Columbia Road to Causeway Street. Southbound on the Central Artery, 2010 AM peak traffic volumes will increase existing congestion levels, particularly north of Dewey Square. Volume-to-capacity ratios ranging between 1.03 to 1.14 have been calculated for highway sections between Dewey Square and the Mystic-Tobin Bridge. Several ramps will also experience LOS F, with volumes much in excess of computed capacities.

Traffic flow in the Sumner Tunnel will continue to operate at LOS F during the 2010 AM peak, with a calculated v/c ratio of 1.37. In the Callahan Tunnel, severe congestion, worse than existing conditions, will result in forced flow (LOS F) operation during the AM peak, with a v/c ratio of 1.17.

PM Peak. During the 1990 PM peak hour, LOS F conditions will prevail on the northbound Central Artery from East Berkeley Street to the High-Level Bridge; LOS E operation will extend back to Columbia Road. The ramps which experience LOS F conditions in 1990 are the same as those in 1982, but will be congested to a more severe degree, as indicated by the higher v/c ratios.

Southbound under 1990 PM peak hour conditions, forced flow operation will prevail on the Artery/Expressway, from the Mystic-Tobin Bridge and Interstate Route 93 to Columbia Road. Central Artery v/c ratios will exceed 1.0 from Dewey Square to Columbia Road. Ratios approaching 1.0 will exist from Dewey Square north to Causeway Street, although downstream congestion will result in LOS F operation on these links. Several southbound ramp junctions will operate at LOS F and cause congestion on these ramps and on the Artery, including the Albany Street on-ramp, due to weaving conflicts with traffic destined to Massachusetts Avenue, the reduction in travel lanes from four to three, and because the ramp itself will carry traffic volumes in excess of its practical capacity; the Haymarket on-ramp will function at LOS F, because of merging conflicts, as will the Callahan Tunnel off-ramp, because of traffic backups from North Street.

Traffic flow in the Sumner Tunnel during the PM peak hour will continue to operate at LOS F, with a calculated v/c ratio of 1.04. Increases in traffic will exacerbate congested conditions not only at the tunnel entrance and exit points but within the tunnel itself because of restricted capacity. Callahan Tunnel PM peak traffic flow will also continue to operate at LOS F and be even more congested in 1990, with a v/c ratio of 1.39. Congestion on southbound Route 1A and the northbound off-ramp to Logan Airport and southbound on-ramp from the airport will increase, with LOS F operation resulting.

By 2010, a slight increase in forecasted traffic growth will stabilize the LOS F conditions predicted for 1990 during the PM peak in both directions on the Central Artery. Corresponding slight increases in v/c ratios at most of the key links and ramps result in LOS F conditions still prevailing. Two exceptions are the Callahan and the Sumner Tunnels, where continued cross-harbor demand will further congest these facilities and their connections (i.e., v/c ratios will increase more). More significant increases in v/c ratios will also occur on the Route 1A - Logan Airport

connections.

Intersections and Local Streets

South Boston Intersections. Under 1990 No-Build AM peak hour conditions, operations at 6 of the 15 key intersections in South Boston will degrade from existing levels of D or better to LOS E or F, including Columbia Circle, Columbia Road/Day Boulevard/L Street, L Street/East First Street/Summer Street, Dorchester Avenue/Broadway, Summer Street/Dorchester Avenue, and Herald Street/Broadway/Frontage Road/Albany Street. In addition, the Congress Street/A Street intersection will experience LOS F operation as compared to its existing LOS E operation. In total, 11 of the 15 key intersections are expected to operate at LOS E or F under 1990 AM peak conditions. The v/c ratios at these intersections are 0.92 or greater. In 2010, these same intersections will continue to operate at LOS E or F; no additional intersections will experience further deterioration in levels of service.

During the PM peak hour three intersections will deteriorate from LOS A-D to LOS E or F by 1990: Andrew Square, Summer Street/Dorchester Avenue, and Herald Street/Broadway/Frontage Road/Albany Street. Seven intersections in total will operate at LOS E or F in the PM peak hour and will continue to do so through 2010.

East Boston Intersections. AM peak hour traffic forecasts for the No-Build Alternative at 16 key intersections in East Boston in 1990 indicate degradation in level of service will occur at Porter Street/Chelsea Street/Visconti Road and Porter Street/Bremen Street (LOS D in 1982 to LOS E). The Porter Street/London Street intersection will continue to operate at LOS F, but at a higher v/c ratio (increased congestion). By year 2010, AM peak hour levels of service will degrade to LOS F at Porter Street/Chelsea Street/Visconti Road and Porter Street/Bremen Street. The Airport Crossover Road intersection will degrade to LOS E.

Under 1990 PM peak hour conditions, no additional intersections will operate at LOS E or F. The intersections of Porter Street/Bremen Street and Route 1A off-ramp/Neptune Road will continue to operate at LOS E and F, respectively. By 2010, four intersections will degrade to LOS E or F during the PM peak: Porter Street/Chelsea Street/Visconti Road, Porter Street/Bremen Street, Porter Street/London Street, and the Airport Crossover Road intersection. In addition, two intersections operating at LOS F in 1990 will continue to do so in 2010.

Bell Circle, Revere. During both peak hours in 1990 and 2010, Bell Circle will operate at LOS F; v/c ratios will range from 1.18 for 1990 and 1.37 for 2010.

Downtown Boston Intersections. Level of service will continue to degrade from 1982 to 1990 at several of the key downtown Boston intersections during the AM peak and PM peak hours. By 2010 eight of the nine key intersections will operate at LOS E-F during both the AM and PM peak hours.

Central Artery Bottlenecks and Congestion Points

Future 1990 and 2010 No-Build Alternative bottlenecks and congestion points and associated queue lengths are also depicted on Figure 11. As indicated in Section 3.1.1, the queue lengths shown are those individual to each bottleneck and congestion point. They do not reflect the cumulative effect of all queue origins on Central Artery congestion.

Year 1990

During 1990 PM peak hour conditions, the queue emanating from the Central Artery northbound approach to the Charlestown High-Level Bridge bottleneck will extend back to the East Berkeley Street on-ramp, approximately the same length as for the 1982 PM peak hour. However, while essentially minor queues develop at other northbound ramp junctions on the

Artery/Expressway in 1982, three additional congested ramp junctions are expected to create queues during the PM peak by 1990. Nearly a two-fold increase in traffic, predicted for the northbound off-ramp to the Callahan Tunnel, is expected to create a queue on this off-ramp which will extend onto the Central Artery and back-up nearly to the Congress Street on-ramp. The Northern Avenue on-ramp merge with the northbound Artery is also expected to cause a queue on the Artery due to significant merging conflicts. This queue is expected to extend from the merge area back to the Massachusetts Turnpike on-ramp. Finally, the East Berkeley Street on-ramp merge with northbound traffic is expected to create a queue extending to the Massachusetts Avenue on-ramp.

Southbound under 1990 PM peak conditions, queues are expected to develop at four congested ramp junctions with the Central Artery (as in 1982), and, with the exception of the Haymarket Square on-ramp queue, they are approximately the same as those which exist in 1982. The Haymarket Square on-ramp will create a queue on the Artery extending to the Storrow Drive on-ramp.

Under 1990 AM peak conditions, three congested ramp junctions with the northbound Central Artery will create queues on the Artery. The Northern Avenue on-ramp is expected to create a queue extending back to the Dewey Square Tunnel portal. No queue exists for 1982 because on-ramp traffic volumes are light (220 vph). However, by 1990, nearly a 400 percent increase in traffic forecast on this ramp will create a queue. A queue comparable to that of 1982 will result at the Massachusetts Turnpike on-ramp to the northbound Central Artery. Finally, the East Berkeley Street on-ramp will create a queue extending back to the Massachusetts Avenue off-ramp. Although traffic volumes on this section of the highway are forecast to be higher in 1990 than in 1982, the Southeast Expressway upgrading project will result in a smaller queue than in 1982.

Southbound on the Central Artery under 1990 AM peak conditions, the congested merge area where the Haymarket Square on-ramp traffic enters the Central Artery will create a queue which will extend back to the southbound Storrow Drive off-ramp. On Interstate 93, the queue formed by the merge at the High-Level Bridge will be 1-1/2 miles long; on the Mystic-Tobin Bridge, the southbound queue will be 1-3/4 miles long.

Year 2010

Queue lengths estimated for the northbound Central Artery in 2010 during the PM peak hour are depicted on Figure 11. The northbound bottleneck at the approach to the High-Level Bridge is expected to create a queue which will extend back to the East Berkeley Street on-ramp. A queue emanating from the Callahan Tunnel off-ramp will extend into the Dewey Square Tunnel, nearly to the South Street on-ramp. Another congestion point, at the merge area where Northern Avenue traffic joins northbound Central Artery traffic, will create a queue on the Artery which is estimated to back up to the Massachusetts Turnpike off-ramp. Finally, the East Berkeley Street on-ramp will create a queue which extends beyond the Massachusetts Avenue off-ramp.

Southbound on the Central Artery during the PM peak hour, four congested ramp junctions will result in queues on the Artery/Expressway. The Columbia Road on-ramp will create a queue extending to the Columbia Road off-ramp area. The Albany Street on-ramp merge will create a queue extending back to the Massachusetts Turnpike off-ramp gore area. A queue emanating from the Haymarket Square on-ramp will extend back to the Storrow Drive on-ramp gore area. Finally, a Callahan Tunnel off-ramp queue will extend back to the Haymarket Square off-ramp.

During the AM peak, queues emanating from four congested ramp

junctions are expected to impede northbound Central Artery/Expressway traffic flow. The Callahan Tunnel off-ramp is expected to queue back onto the Artery and extend nearly to the Northern Avenue on-ramp; no queue on the Callahan Tunnel off-ramp was estimated to occur in either 1982 or 1990 conditions. Three other congested ramp junctions from which queues will emanate in 1990 will continue to do so in 2010. The Northern Avenue on-ramp merge with the Central Artery will create a queue extending beyond the Massachusetts Turnpike on-ramp. The Massachusetts Turnpike on-ramp will also cause a queue to extend back beyond the Massachusetts Avenue off-ramp. In addition, a queue emanating from the East Berkeley Street on-ramp is expected to extend beyond the Massachusetts Avenue on-ramp.

In the southbound direction, during the AM peak two congested ramp junctions which caused queues in 1990 will continue to be congested in 2010. These ramp junctions are the Haymarket Square on-ramp merge area, with a queue extending nearly to the Mystic-Tobin Bridge on-ramp, and the Callahan Tunnel off-ramp, with a queue extending back nearly to the Haymarket Square off-ramp. Also, southbound queues caused by the merge at the High-Level Bridge will create queues of 3-1/4 miles on Interstate 93 and 2-3/4 miles on the Mystic-Tobin Bridge.

3.1.3 Safety

Historic accident data for selected locations within the project area were tabulated yearly for the three years, 1978 through 1980. Average yearly accidents and average accident rates were also determined for each roadway location.

Roadways selected for analysis include the Central Artery and Southeast Expressway, from the Mystic-Tobin Bridge to Southampton Street; the approaches to the Callahan and Sumner Tunnels in Boston and East Boston; and a limited number of intersections within South Boston and East Boston.

For ease of presentation, the Central Artery and Southeast Expressway have been divided into four sections:

1. The Central Artery, extending from the Interstate Route 93/Route 1 interchange in Charlestown south to and including the Causeway Street and Haymarket ramps on the Artery.

2. The Central Artery south of the Haymarket and Causeway Street ramps, and including the ramps to the Callahan and Sumner Tunnels.

3. The Central Artery south of the Callahan/Sumner Tunnel ramps to just north of Kneeland Street, including the Northern Avenue, Dewey Square, High Street, Purchase Street and Atlantic Avenue ramps.

4. The Central Artery and Expressway, including the interchanges with Kneeland Street, Massachusetts Turnpike, Albany Street, Massachusetts Avenue and Southampton Street.

Table 3 summarizes the existing accident history (average of 1978-1980 statistics) along the Central Artery/Southeast Expressway in downtown Boston and at the Route 1A approaches to the toll plaza of the Callahan and Sumner Tunnels in East Boston. Along the four study sections of the Central Artery and Southeast Expressway, more than 1000 accidents occurred yearly. Section 1 had the largest share of annual accidents at 381. The approaches to the Callahan/Sumner Tunnel toll plaza in East Boston averaged approximately 160 accidents yearly. Because the average speeds of vehicles on these facilities is relatively low, the percentage of these accidents involving fatalities is significantly less than one percent.

Also listed in Table 3 are projected future accidents for the years 1990 and 2010 without the project. Average yearly accidents are projected to increase as a result of increased traffic volumes.

Table 3

YEARLY ACCIDENT SUMMARY

	Average 1978 - 1980	Future 1990	No-Build 2010
Highway			
Central Artery			
Section 1:			
Rte. I-93/Rte. 1 to Causeway St./ Haymarket Ramps	381	454	470
Section 2:			
Callahan/Sumner Tunnel ramps	235	260	284
Section 3:			
Northern Avenue to Dewey Square ramps	197	201	232
Section 4:			
Kneeland Street to Southampton Street ramps	200	203	206
	1013	1118	1192
Callahan/Sumner Tunnel Approaches (East Boston)	159	164	226
Total Highway Accidents	1172	1282	1418
Intersections			
South Boston			
Columbia Road/Old Colony Avenue/Day Boulevard	11	14	15
Andrew Square	8	11	12
Columbia Road/Day Boulevard/L Street	5	5	5
L Street/Summer Street/E. First Street	7	9	9
Dorchester Avenue/West Broadway	9	9	10
Summer Street/D Street	10	10	10
Dorchester Ave./W. Fifth St./A St.	10	9	10
Dorchester Ave./W. Fourth St.	10	10	10
Congress St./A St.	4	6	7
Northern Ave./Sleeper St.	8	13	14
East Boston			
Condor Street/Meridian Street	13	13	14
Bennington Street/Bremen Street	7	7	8
Bennington Street/Chelsea Street	23	24	25
Meridian Street/Bennington Street	13	14	15
Porter Street/Cottage Street	2	3	3
Total Intersection Accidents	140	157	167
Total Accidents	1312	1439	1585

Table 3 also summarizes the existing accident history and predictions of future yearly accidents at selected intersections within both South Boston and East Boston. In general, future intersection accidents are predicted to change slightly by location, consistent with only minor traffic volume changes through these intersections. As with the major sections of the Central Artery, the percentage of accidents which involve fatalities is minor.

3.1.4 Other Transportation Facilities

In addition to the roadway network, an extensive system of other transportation facilities also serve the project area. These services range from bus and taxi services to rapid transit, heavy rail and air travel services, and are offered by both public and private carriers.

The primary public transportation service across Boston Harbor is provided by the Massachusetts Bay Transportation Authority's (MBTA) Blue Line rapid transit line. Figure 12 shows the location of the Blue Line, as well as other rapid transit and bus routes operated by the MBTA within the project area.

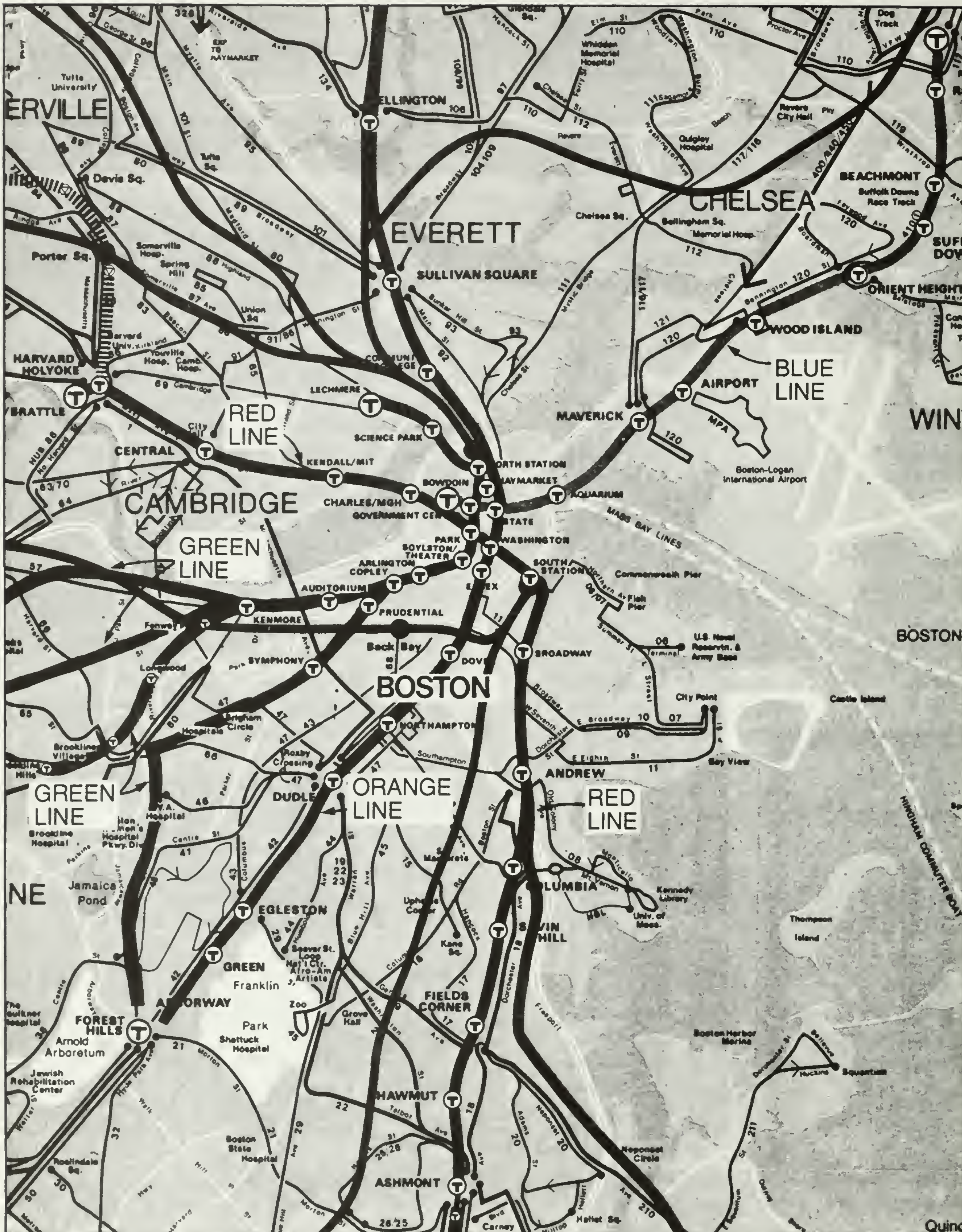
The Blue Line begins in downtown Boston and proceeds in a subway tunnel northeasterly, passing under Boston Harbor and into East Boston, emerging from the subway just north of Porter Street at Airport Station. The Blue Line continues primarily at-grade on an exclusive right-of-way through East Boston and into Revere. Stations on the Blue Line in East Boston include Maverick, Airport, Wood Island, Orient Heights and Suffolk Downs. The Blue Line generally operates from approximately 5:30 AM to 1:00 AM, with trains scheduled at 4-5 minute headways during morning and evening peaks, 7-8 minute headways at other times during the day, and up to 12 minute headways at nights and on weekends.

The only other direct cross-harbor transit services provided by the MBTA, and which utilize the Callahan and Sumner Tunnels, are five express bus routes (Routes 400, 440, 441, 442, and 450), all having a downtown Boston terminus at Haymarket Square. None of these routes make stops either in East Boston or Revere.

The MBTA's Red Line rapid transit also directly serves the project area through South Boston and the Central Business District. Beginning in Cambridge, the Red Line crosses the Charles River into downtown Boston, with stops at Park Street, Washington Street, and South Station. Beyond South Station, the Red Line curves southerly under Fort Point Channel, with Broadway Station (at the intersection of Broadway and Dorchester Avenue) the first stop in South Boston. Beyond Broadway Station, the subway continues to a station at Andrew Square, where it surfaces and splits into two branches, the older branch to Ashmont (Mattapan) and the newer branch to Braintree. Red Line headways are somewhat longer than those of the Blue Line on the two outer portions, but are more frequent north of Andrew Station.

The MBTA also provides local bus service within both East Boston and South Boston. In East Boston, there are four such routes (Routes 116, 117, 120, and 121). Routes 116 and 117 begin at Maverick Station and terminate at Wonderland Station in Revere; Route 120 runs between Maverick and Orient Heights Stations; and Route 121 operates between Maverick and Wood Island Stations.

Within South Boston, the MBTA operates five local bus routes (Routes 6, 7, 9, 10, and 11). Route 6 connects the Boston Army Base with Haymarket Square; Routes 7 and 11 connect the City Point area of South Boston with downtown Boston; Route 9 begins at City Point and terminates at Copley Square in Boston's Back Bay; and Route 10 runs from City Point to the MBTA Orange Line's Dudley Station in Roxbury. The Summer Street and Broadway Bridges across the Fort Point Channel are used by the bus routes



MBTA Subway Line
Subway Under Construction
Subway Station
MBTA Bus Route

Figure 12
Public Transportation Facilities

0 ¼ ½ 1 Mile

EIS/EIR for I-90, The Third Harbor Tunnel

connecting South Boston and downtown Boston.

At Logan Airport, several forms of surface public transportation are available. Massport operates an airport bus service which connects the MBTA's Airport Station on the Blue Line with the airline terminal buildings using the airport's looped access roadway system; a separate segment of this service circles among the terminals without stopping at the MBTA station, using a portion of the access roadway system. The most prevalant public transportation service provided at Logan Airport is by taxis.

Limousine service to and from the airport is also available to numerous outlying areas in Massachusetts and New Hampshire and to downtown Boston hotels. Scheduled common-carrier bus service is also offered to a number of locations in Massachusetts, Rhode Island, and Vermont. Taxis, limousines, bus, and automobile rental traffic account for approximately 32 percent of the passenger vehicle trips generated by the airport.

Primary ground access to the airport is from ramps off Route 1A to the airport access/egress roadway system. This system loops around the landside portion of the airport, providing connections to the four major terminals and the central parking garage. A portion of this roadway loop system is double-decked, the upper level serving departing passengers and the lower level serving arriving passengers. Other roadways which branch off this central loop serve the freight terminals, auto rental agencies, airline maintenance facilities, reservation centers, etc. On-airport service roads also connect to the local East Boston street network via Porter Street on the south and Prescott Street/Neptune Road on the north. These connections primarily serve the airport's support facilities (maintenance, air freight, car rental, etc.), but are also used by others (taxis, limousines, private vehicles, etc.) as "escape routes" to avoid traffic congestion on the airport's main roadways and along Route 1A on the approaches to the Callahan and Sumner Tunnels, as well as for local access from the adjacent neighborhood to the airport.

In addition to Logan Airport, another major transportation complex within the project area is South Station. Amtrak trains depart from this terminal throughout the day for points along the Northeast Corridor as far as Washington, D.C., and to Chicago. The MBTA operates five commuter rail lines from South Station to Attleborough, Stoughton, Franklin, Framingham and Needham (the Needham line is temporarily out of service). Extensive commuter and long-distance bus service is also available from the South Station area.

Although there is no cross-harbor ferry service currently operating, there have been several proposals in recent years for the restoration of these services. Proposals for cross-harbor ferry systems have been considered by Massport which would link the airport with one or more locations in downtown Boston, South Boston, or Charlestown.

Future development proposals in the area are expected to result in increased traffic demand and subsequently increased public and private transit usage. Projections of future ground traffic generated by activities at Logan Airport, without construction of a Third Harbor Tunnel, indicate an approximate 40 percent increase over existing ground traffic. At South Station, the amount of bus service will increase significantly in the future when Greyhound and its affiliated companies relocate their operations to the proposed South Station Transportation Center, now under construction.

3.2 LAND USE AND ECONOMIC ACTIVITIES

This section contains a brief overview of land use and economic conditions in the project area, and

descriptions of the individual neighborhoods.

The project area is divided into twelve districts (see Figure 13). From south to north these are: South End, Industrial Triangle, South Boston, Fort Point Channel, Leather District, Chinatown/South Cove, Financial District, Waterfront, North End, East Boston, Logan Airport, and Route 1A North.

More detailed information on land use, economic characteristics, and other supportive information is contained in Land Use, Community Facilities, and Economic Activity Inventory, a supplemental report prepared as part of this study.

Overview

The general land use and economic base of the project area is highly diverse. Downtown Boston houses financial, administrative and office-based services. A wide variety of distribution, food processing, utility, transportation and other activities are also located in and around the downtown area. South and southwest of downtown, service, warehousing and light manufacturing uses predominate.

Large, four- to six-story older brick buildings in the Fort Point Channel area house manufacturing industries such as printing, and wholesaling of furniture, office supplies and electrical parts and equipment. Former warehouse buildings in this area are being converted to studio, residential and office use. Development parcels near the mouth of the Channel are attracting major office, commercial and housing development to the area.

South Boston's northern section is the location of Commonwealth Pier and several large industrial areas, including a major portion of Boston's marine-related activities. This area also contains large tracts of underdeveloped land with good regional and downtown access. The southern half of South Boston is a large residential neighborhood.

The Industrial Triangle's land uses include light manufacturing, wholesaling and distribution, and storage and maintenance of transportation equipment.

The South End encompasses a large residential neighborhood, an industrial/commercial corridor along Albany Street, and two major hospitals.

East Boston is primarily residential, with some commercial and retail activity. Sections of East Boston contain airport-related uses such as car rental, parking, and freight forwarding.

Logan Airport is a full service national and international facility with a full complement of freight forwarding, car rental, hotel and air transport land uses.

The project area comprises a key segment of the local and regional economy. Downtown Boston is central to the function of New England's banking industry and postal distribution network. A large percentage of Boston's manufacturing firms are located within the project area. Distribution facilities such as the wholesale food markets and flower exchange serve regional markets.

While some direct functional links exist between sections of the project area, the sections remain basically economically independent. Exceptions include the link between downtown and Logan Airport and the spillover into East Boston of airport-related activities such as car rental.

3.2.1 South End

The South End contains several socially distinct residential neighborhoods lying mostly to the west of Harrison Avenue. These consist largely of older row houses and newer, multi-family developments.

The South End's central

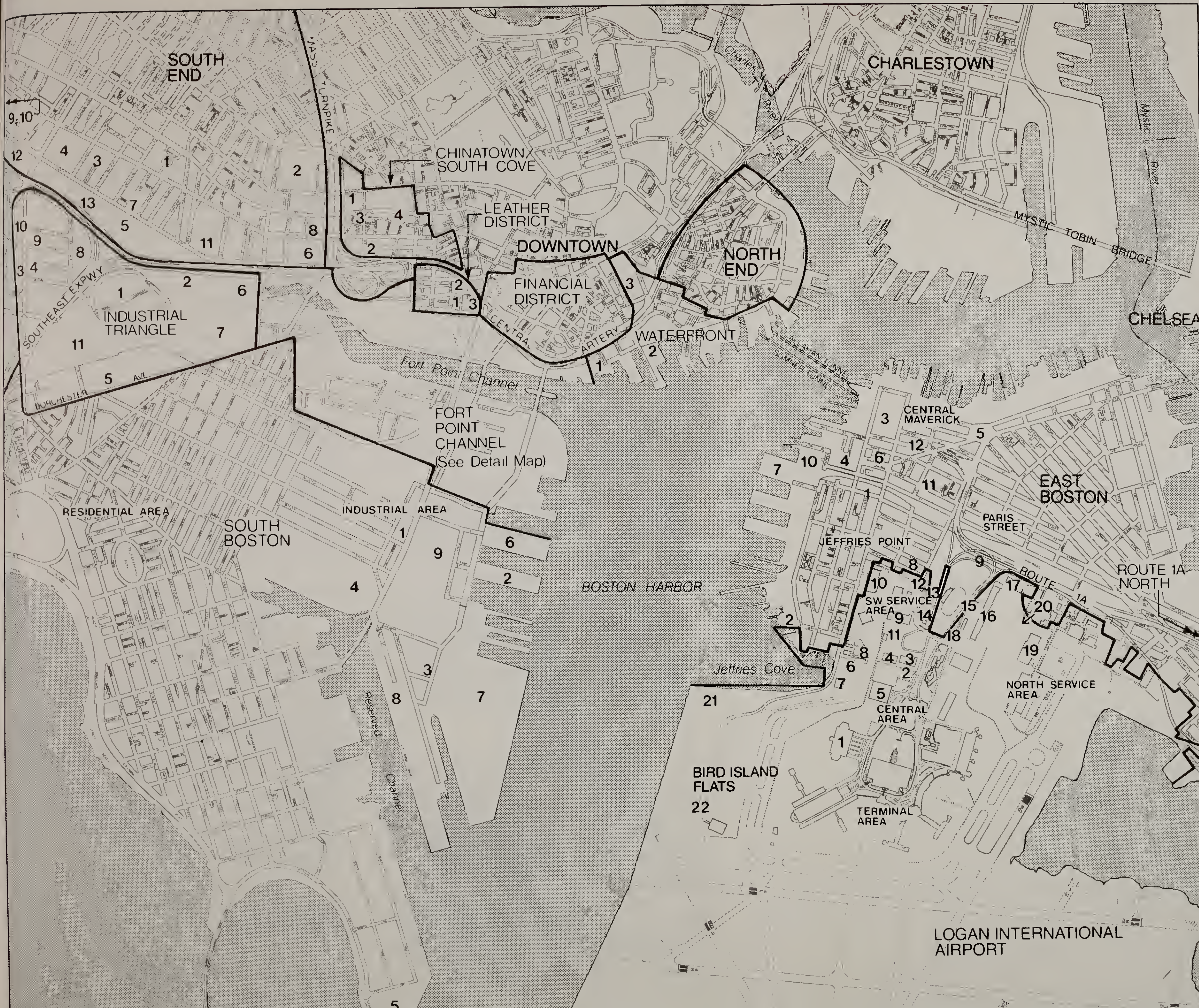


Figure 13
Major Land Uses

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend
— Neighborhood Boundaries
1 Land Uses Identified in Text

location, good highway access, and inexpensive land and building space are the basis of its economic activity. An industrial and institutional corridor lies along the Central Artery/Southeast Expressway/Albany Street. Activities in the industrial corridor include light manufacturing, wholesaling, distribution, and warehousing. Industrial uses are located both in older, often rehabilitated structures, of five-to-six stories, and in new low-rise buildings. There are several new multi-story industrial buildings, such as that of New England Nuclear on Albany Street. Most of the smaller businesses have been in their current location for over 20 years. New high tech firms entering the area occupy new or substantially renovated facilities.

Major land uses in the area are shown on Figure 13 and listed in Table 4, and include two major hospital complexes, Boston City Hospital and the Boston University Medical Center.

There are approximately 1,015,000 square feet of industrial building space in this area. Retail, commercial, and institutional activities occupy approximately 613,000 square feet.

The South End's older industries tend to serve a regional market area largely by truck (approximately 4300 truck trips per week). The newer, high tech and bio-medical industries require good, primarily automobile, access to the airport and downtown areas.

Retail, commercial, and institutional activities generate 2100 truck trips per week. The two major hospitals, the principal employers in the area, serve the entire region, and benefit from their central location with good highway and reasonable airport access.

There are approximately 10,300 employees in the Albany Street area of the South End; the two hospitals accounting for about 70 percent of the total. A majority of the area's employees drive to work. However, the hospitals, Digital Equipment Corporation and some other companies draw many of their employees from the South End, South Boston, and Roxbury. Many of these employees walk or use public transportation.

Future land use plans for the South End include further development of the Crosstown Industrial Park, an industrial development of the Boston Economic Development Industrial Corporation (EDIC); and a proposed medium-sized hotel and office building on BRA Parcel 46B, under consideration for development by South End Technology Square Associates (SETSA), an association of South End hospitals and industries. (The locations of these developments are shown on Figure 13 and listed in Table 4.)

The future of the South End may include continued growth in the institutional, high tech, and bio-medical industries, and in associated commercial development. However, the older, established industries and commercial businesses anticipate little future expansion. It is likely that truck trips will continue to be generated by a few major sources.

3.2.2 Industrial Triangle

This area includes the industrial lands lying between the Southeast Expressway, the West Fourth Street Bridge, Dorchester Avenue, and Southampton Street (see Figure 13). The industries in the 230 acre area include warehousing, food and freight distribution, wholesale suppliers, and public garage and maintenance facilities; all are uses dependent on good truck access to the regional highway network. The area houses approximately 1,180,000 square feet of space, mostly in large distribution or warehouse facilities.

Major facilities in the area include: are located on Figure 13 and listed in Table 4.

The area generates large volumes of highway-dependent traffic,

Table 4

MAJOR LAND USES IN PROJECT AREA*

South End (see Figure 13)

1. Cathedral Sq. Housing Project
2. Castle Sq. Apartments
3. Boston Univ. Medical/Dental Center
4. Boston City Hospital
5. Boston Flower Exchange
6. Boston Herald American
7. New England Nuclear
8. Teradyne Company
9. Stride-Rite Corporation
10. Digital Equipment Corp.
11. MBTA Bus Storage/Maintenance
12. Crosstown Industrial Park
13. Hotel/Office Building (Proposed-Parcel 46B)

Industrial Triangle (see Figure 13)

1. New Boston Food Market
2. Expressway Consolidated Group
3. Massachusetts Wholesale Food Market
4. Southampton Street Businesses
5. Dorchester Avenue Industries
6. Boston Public Works Garage
7. MBTA Cabot Yards
8. Boston Incinerator (Public Works)
9. Boston Traffic and Parking Dept. Operations Center
10. Boston Fire Dept. Headquarters and Garage
11. Boston Service Facility

South Boston (see Figure 13)

1. Fargo Building
2. Fish Pier
3. Boston Marine Industrial Park
4. Boston Harbor Industrial Park
5. Conley Marine Terminal
6. Commonwealth Pier
7. Massport Marine Terminal
8. South Boston Army Base
9. Commonwealth Flats

Fort Point Channel (see Figure 14)

1. Stone and Webster Corp.
2. Federal Reserve Bank
3. Harbor Plaza
4. Hook Lobster Company
5. Russia Wharf
6. Neptune Lobster Company
7. The Boston Tea Party Ship Museum
8. Children's Museum

Fort Point Channel (cont'd) (see Figure 14)

9. South Station Transportation Center
10. Rail Yards (commuter rail/Amtrak)
11. MBTA Red Line Southampton Yard
12. South Postal Annex
13. Boston Edison Kneeland St. Generating Plant (proposed Wang Corp. development)
14. Boston Edison Substation
15. McKie Lighter Company
16. Gillette Company
17. MDC Combined Sewer Overflow Treatment Facility (proposed)
18. MBTA Wye Connector (proposed)
19. MBTA (Old Colony) Railroad Bridge
20. Appraisers Stores Renovation
21. Bain Building
22. Rowe's and Foster's Wharves
23. Northern Avenue Bridge
24. Athana's Pier's 1-4
25. Penn Central Parcel
26. Rose Associates/Town and Cities Properties
27. 303 Congress Street

Leather District (see Figure 13)

1. Essex Hotel
2. Teradyne Company
3. Dewey Square Office Tower

Chinatown/South Cove (see Figure 13)

1. Mass. Pike Towers
2. Tai Tung Village
3. Quincy Tower
4. Tufts-New England Medical Center

Waterfront (see Figure 13)

1. Harbor Towers
2. Long Wharf Marriott Hotel
3. Faneuil Hall Marketplace

East Boston (see Figure 13)

1. Victory Gardens
2. Bethlehem Steel (currently vacant)
3. Maverick Housing Development
4. Heritage Apartments
5. Central Square shopping area
6. Maverick Square shopping area
7. Massport Piers 1-4

East Boston (cont'd) (see Figure 13)

8. George Page Hotel (proposed)
9. Holiday Inn (proposed)
10. NDP II residential development (proposed)
11. Lyman School
12. Maverick Square Post Office

Logan International Airport (see Figure 13)

1. Eastern Airlines Terminal
2. Eastern Airlines Fuel Farm
3. Eastern Airlines Cargo Building
4. Hill Cargo Building
5. Eastern Airlines Hangar
6. Van Duesen/Air Associates
7. Eastern Airlines Reservations Center
8. General Aviation Building
9. Emery Air Cargo Building
10. U.S. Postal Service Airmail Facility
11. National Car Rental
12. Dollar Car Rental
13. Avis Car Rental
14. Hertz Car Rental
15. United Flight Kitchen
16. Central (Williams) Cargo Building
17. Pan Am Cargo Building
18. Airport Exxon Station
19. Delta Reservations Center
20. Robie Airport Park
21. Bird Island Flats Mixed Use Development
22. Bird Island Flats Air Cargo and General Aviation Facilities

Route 1A North (see Figure 15)

1. Suffolk Downs Racetrack
2. Wonderland Racetrack
3. Ramada Inn
4. Car Rental (3 firms)
5. Fuel Tank Farms
6. Structural Steel Fabricating Plant
7. P & L Sportswear
8. Towle-Leonard Factory

both truck and auto; there are approximately 10,000 truck trips per week, and most of the area's 3150 employees drive to work. Despite localized areas of congestion and heavy rush hour traffic, the Industrial Triangle's central location and proximity to regional highways give it excellent access for the regional distribution system which is the basis of its economic activity.

Companies in the Industrial Triangle are to some extent interdependent, with substantial truck volumes circulating between the food distribution centers near Southampton Street and Widett Circle via the Frontage Road, Albany Street, and Central Artery.

The one proposal in the area for future development is the Boston Service Facility, an improvement project by Amtrak at the Cabot Yards, Yard 5, and the Southampton Yards. The project is underway and ultimately, tracks will be lowered, and inspection, maintenance, and office facilities will be built. A surface parking lot for 250 cars is planned. Access to the improved yards will be from Frontage Road and Southampton Street. This facility is shown on Figure 13 and listed in Table 4.

No private development plans have been identified in the Industrial Triangle.

3.2.3 South Boston

South Boston is a 2400 acre peninsula connected to Boston by ten bridges across Fort Point Channel and the railroad tracks west of Dorchester Avenue. South Boston includes residential neighborhoods, heavy industry, warehousing, transportation facilities, and a large, historically significant park at Castle Island.

South Boston can be divided into two distinct areas of nearly equal size: the northern industrial section, and the southern residential section. The division of these areas occurs approximately at First Street (see Figure 13). A smaller industrial area lies between Old Colony and Dorchester Avenues.

Economic activities in the southern residential section are predominantly retail and commercial, aimed primarily at local residents with neighborhood business districts along West Broadway and East Broadway.

The northern section of South Boston is one of the city's largest heavy industry areas. The majority of land in this area is owned by Massport and City of Boston EDIC, with several major parcels leased to private businesses.

Industrial uses include trucking, warehousing and distribution, marine industries, fuel farms, and power plants. There are also a growing number of office buildings in the area and several commercial and retail establishments. These activities are located in South Boston because of its port facilities, large areas of relatively inexpensive land, and proximity to downtown Boston.

Major facilities are shown in Figure 13 and listed in Table 4.

The industrial section of South Boston is heavily dependent on access to the regional highway system and generates approximately 10,000 truck trips per week. Access is currently a limiting factor to the area's economic growth due to congestion on major streets. Chief access routes are Northern Avenue, Summer Street, Broadway, West Fourth Street, and Southampton Street. Thousands of employees and restaurant patrons drive to the area. Weight restrictions on bridges limit trucking to the Broadway and Southampton Street Bridges, and traffic congestion affects access to the Central Artery and Massachusetts Turnpike.

Steady increased industrial development is likely to take place and both property values and employment are likely to increase in the future, particularly if access is

improved. The basic profile of industries in the area (excluding the Fort Point Channel area) is not likely to change substantially.

There are a number of projects already planned or under construction in South Boston. These include: Commonwealth Pier, currently an 11 acre passenger ship facility, being redeveloped as a marketing and communications center for the computer/information industry; Massport Marine Terminal, a container port under construction on land leased from the EDIC; South Boston Army Base, redevelopment of 3 million square feet of building space with a portion to be be leased by EDIC to the garment industry; and Commonwealth Flats, a 3.5 acre parcel to be used for parking. (See Figure 13 and Table 4.)

3.2.4 Fort Point Channel

Fort Point Channel is located between Boston and the northern section of South Boston. Land surrounding the Channel is devoted predominantly to commercial, industrial and transportation uses. Although the area has no formal designation as a neighborhood, it is perceived as a distinct land use area adjacent to downtown Boston. Major facilities are shown on Figure 14 and listed in Table 4.

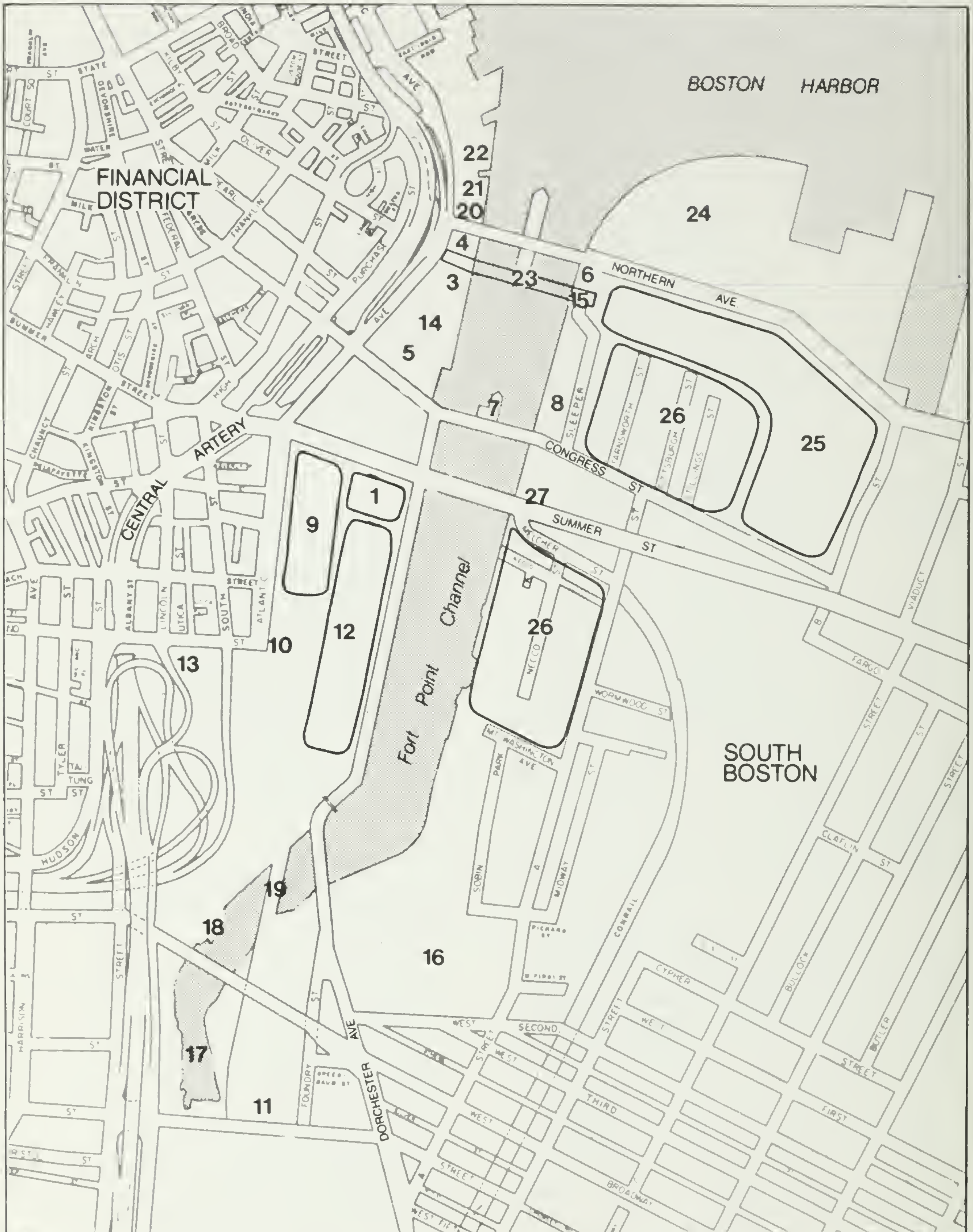
The South Station area is occupied mostly by large public facilities, including several transportation facilities undergoing renovation. Over 3.5 million riders each year use the railroad and commuter rail facilities at South Station. The South Postal Annex, Boston's central mail distribution facility located adjacent to South Station generates 900 truck trips per week and employs 9800 people. Also located in the area are the Trailways bus station, and MBTA subway car storage.

Until recently the Boston side of Fort Point Channel was dominated by warehouses and vacant land used for parking. Recently, the area has been the site of significant office development; from the Harbor Towers complex to the Stone and Webster building on Summer Street, the area is almost entirely devoted to professional office space, reflecting its location on the periphery of the Financial District. (Although the Central Artery west of Atlantic Avenue remains a barrier to the downtown Financial District, its influence as a dividing line has declined as more office buildings have been built or renovated east of it). The James Hook Company, a wholesaler of live lobsters, also located in the area, is an exception to the general pattern of activity and occupies a substantial underutilized developable parcel.

Rents are approaching $30 per square foot per year in rehabilitated space, and land values are approximately $200 per square foot. A small number of retail establishments serving office employees are located on the ground floors of several office buildings. Approximately 12,000 employees work in over 3 million square feet of office space, many of them parking across the Fort Point Channel in South Boston. The area generates about 100 truck trips per week.

The South Boston side of Fort Point Channel is characterized by mixed warehousing, commercial and industrial uses in older (late 19th-early 20th century) buildings of one to ten stories. There are also a number of abandoned rail yards, many of which are used as parking lots. A few marine-related companies remain along the Channel bulkhead. Museum Wharf, which houses the Children's Museum, has been landscaped as a park with a public access easement held by the Boston Parks and Recreation Commission. The Museum attracts over 500,000 visitors annually.

Industrial uses in this area include light manufacturing, printing and publishing, clothing manufacturing, wallcovering distribution, and seafood processing. As in the South End, these industries are attracted by the



1 Land Uses Identified in Text

Figure 14
Major Land Uses—Fort Point Channel

0 200 400 800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

area's central location and inexpensive space which more than compensates for poor loading facilities and multi-story building layout. (The Gillette Company, with its own modern facilities, is an important exception.) Rents of $2.50-$5.00 per square foot per year are typical of these buildings.

A number of buildings have loading docks which face directly onto Summer, Congress, or A Streets, or onto side streets. On-street loading disrupts the area's traffic circulation. Approximately 1000 truck trips occur weekly in this area.

Commercial uses include furniture and houseware retailers, art galleries, studios, restaurants, commercial parking lots, and office space. A small number of buildings on Sleeper and A Streets have been converted to residential use.

As with the industrial users, the area's low cost space is attractive to retailers. Restaurants and offices are attracted to this section of Fort Point Channel because of its proximity to downtown Boston, and pay rentals approaching $19 per square foot per year in renovated space. For condominium conversion and some office uses, the historic character of the area and its proximity to the Channel itself are significant amenities.

There are numerous development proposals for the Fort Point Channel area, due to its potential water-related amenities and convenient location. The proposals include major new office and residential developments and continued rehabilitation of existing structures for offices and condominiums. (See Figure 14 and Table 4.)

Specific changes include improvements to the South Station Transportation Center which are currently underway, construction of a new Northern Avenue Bridge, and development of the Athanas Pier 1, Cabot Cabot and Forbes, and Rose parcels. Employment in the area is expected to increase dramatically as these changes take place. Truck volumes may decrease somewhat as the area's economy shifts to office uses. Trips to the airport and across the Channel bridges will increase.

The Channel area, a potential National Register Historic District, has been the focus of several marine-oriented recreational land use concepts. The Boston Harbor Associates, Boston Educational Marine Exchange, Boston Conservation Commission, Sierra Club, and other groups have presented concept plans or voiced support for such plans. Access problems and poor water quality have hampered revitalization of the area, particularly for recreational uses.

3.2.5 Leather District

The Leather District is a nine block area of mostly fiveand six-story brick loft structures built in the 1880's. It is located one block west of Fort Point Channel.

Major land uses in the area are office, warehousing, manufacturing and commercial (see Figure 13); there have also been some conversions to residential use. Manufacturing uses include the Teradyne Co., an electronics firm with approximately 650 employees, and several small firms serving the restaurant industry in nearby Chinatown. Commercial uses include warehousing, office space, and artists' studios. Office space in the area will increase by nearly one million square feet with the completion of the Dewey Square Office Tower to over 1,300,000 square feet in 1983. Truck traffic in the area is estimated at 200 trips per week. Access to the regional highway system is relatively easy via the Kneeland Street ramps.

The economy of the area is changing from the traditional leather and garment-oriented firms still occupying space in the district, to a variety of newer businesses for which multi-story space is suitable and proximity to downtown is important. Proximity to South Station is an

additional benefit. Renovation of the existing structures has started, and will almost certainly continue over the next twenty years.

The District's historic status is both an amenity for office uses and a source of investment tax advantages. Therefore, the District's development will probably benefit from the area's potential eligibility as a National Register Historic District.

Infill development (development on scattered vacant lots) and some redevelopment is likely; property values and employment are expected to increase. Trends indicate that future land use will probably be a mixture of residential, commercial, office, and light manufacturing uses. Dewey Square Office Tower will provide two underground parking levels, and retail, restaurant and theater uses at street and mezzanine level.

3.2.6 Chinatown/South Cove

Chinatown/South Cove (see Figure 13) is a predominantly Chinese residential neighborhood within a light industrial district. Major institutional and commercial uses are also located in the area. Buildings are typically fourto seven-story warehouses and older, medium-rise office buildings. Housing units are concentrated in three large towers with a number of three-story brick row houses also in the area. The Tufts New England Medical Center is a major institutional land use in the district.

The economy of the area is strongly linked to the Chinese community, both as a source of labor in the garment industries and as the primary patrons of the area's retail businesses. Clothing manufacturing, the major industrial use in this neighborhood, takes place in a number of small firms along Kneeland Street. The area to the north of Kneeland Street is primarily commercial, containing restaurants, import-export firms, and several Chinese-language movie houses. South of Kneeland Street the area is primarily residential and institutional, with a small number of retail establishments, chiefly food stores, geared to the local market. (Major facilities are shown in Figure 13 and listed in Table 4.)

South of Kneeland Street most development activities are being initiated by Tufts University. Tufts has recently acquired two buildings occupied by garment manufacturers which it plans to convert to institutional use. Plans are also under way for a new Tufts library. The institutional facilities have little interaction with the other businesses in the district apart from restaurant clientele.

The development by EDIC of a garment center at the former Army Base in South Boston will permit institutional expansion in this neighborhood while preserving jobs for nearly 1500 employees in the area's many small garment industries.

Property values are likely to remain stable, and employment will drop following the garment industries' relocation from the area. Because Chinatown is adjacent to the rapidly developing lower Washington Street area, it may come under development pressure.

The BRA is trying to encourage the construction of residential building in Chinatown/South Cove. North of Kneeland Street, however, former garment industry buildings are being converted to commercial space by private property owners.

3.2.7 Financial District

The downtown Financial District is bordered by the Central Artery and the downtown retail district. It is characterized by multi-story office buildings, some with commercial uses on the ground floors.

The majority of the nearly 1.2 million square feet of building space in the area is devoted to professional offices including insurance companies,

brokerage houses, communications firms, and corporate headquarters. Rents approach $40 per square foot per year in new (Class A) space and $30 in renovated space.

The Financial District is undergoing continued development through construction of new office towers and renovation of existing buildings. A major office development of two million square feet has been proposed for the Fort Hill area.

Immediately adjacent to the project area are several smaller buildings still used for light manufacturing and warehousing. There are also several parking facilities, the Fort Hill Fire Station, and the office of the Massachusetts Industrial Finance Agency. This area generates approximately 375 truck trips per week.

Interaction between the Financial District and neighboring districts, chiefly the Central Business District, Government Center, and the Waterfront area, is considerable, and generates substantial pedestrian traffic. Downtown retail establishments estimate that 44 percent of their customers are office workers. As activities in the Fort Point Channel area and Leather District change to office use, there will be increased interaction between those areas and the Financial District.

The Financial District is a dense employment center whose employees arrive via regional highways (often parking outside the District) and via commuter rail, intercity bus, and rapid transit.

3.2.8 The Waterfront

The Waterfront area (see Figure 13) is characterized by retail and commercial establishments and is one of the major tourist centers of the city; Faneuil Hall Marketplace attracts over 12 million visitors annually, and the New England Aquarium and Discovery Barge have over 900,000 visitors per year. The Waterfront area has recently gone through a period of residential development which includes the two 40-story Harbor Tower buildings and the converted granite warehouses on the piers along the waterfront north to the North End.

Most of the buildings are devoted to retail uses on the ground floors, with office or residential uses on the upper floors. A number of restaurants, parking lots, hotels, and other tourist-related businesses are also located here. Development in the Waterfront area is approaching completion.

The Waterfront area is dependent on good access to the regional highway system both for truck deliveries and for tourist traffic; approximately 25 percent of visitors arrive by car. Pedestrian accessibility is also very important to the area's economic well being.

3.2.9 North End

Directly north of the Waterfront area is the North End, (see Figure 13), a dense neighborhood composed of threeto five-story brick residential structures, often with commercial uses on the ground floor. Hanover Street, the primary retail center, is a mix of small shops catering primarily to local residents, and restaurants, cafes, and pastry shops which attract a regional clientele. Salem, Cross, and Parmenter Streets are also major commercial streets. Because of the narrow streets and crowded parking, vehicular access to this area is difficult at all times.

A small warehousing and industrial area is located on one edge of the neighborhood at the intersection of Commercial and North Washington Streets. The value of this space and its future use will probably change following redevelopment of the North Station area (ongoing).

The portals and ventilation building for the Callahan/Sumner Tunnels are located in this neighborhood.

3.2.10 East Boston

East Boston is primarily residential, with scattered retail activity serving its residents in Central Square, Maverick Square, along Meridian Street, and in first floor corner stores throughout the neighborhood. Industrial and commercial activities are found in Jeffries Point and in the area around the intersection of Bremen and Porter Streets.

Three neighborhoods are included in the project area: Jeffries Point, Central/Maverick and Paris Street. Major land uses in the neighborhood are shown on Figure 13 and listed in Table 4.

Jeffries Point is primarily a residential area, with a major industrial use, Bethlehem Steel, located on piers at the southwest edge of the Point. This facility recently closed but may reopen in the future. Two- and three-decker row houses cover the hill between the airport and Marginal Street.

Industrial uses located on Orleans Street between Porter and Gove Streets include a clothing manufacturer, a paper box manufacturer, and a welding and wrought iron company. Approximately 275 employees work in the area. These industries require about 25 truck trips per week. The inexpensive local labor force and extremely low building rents, often \$1.00-\$2.00 per square foot per year, are major reasons for the location of these firms in the area. Access to regional highways is reasonably good in all directions.

Some encroachment of airport-related industrial use has occurred along Maverick Street. A small cluster of shops is located on Sumner Street, but most of the commercial needs of Jeffries Point residents are met outside the neighborhood's boundaries.

The Central/Maverick neighborhood lies west of Jeffries Point (see Figure 13), and contains East Boston's primary retail shopping area. Central Square has a modern shopping plaza, a wide variety of stores, and a parking area. The existing tunnel portals are located approximately one block southeast of Central Square.

Maverick Square is four blocks south of Central Square on Meridian Street. Although smaller than Central Square, it has an MBTA subway and bus station, convenience shops, and a number of restaurants and bars which serve people from nearby neighborhoods. If new development occurs on the waterfront, Maverick Square's importance as a commercial center will increase.

Homes in the Maverick/Central area are predominantly three-story brick or frame row houses. Several large residential developments are also located in the area. The area between Chelsea Street and the railroad right-of-way is primarily residential.

The Paris Street neighborhood lies north of Porter Street (see Figure 13). It is an area of threeand four-story row houses, with a concentration of commercial and industrial uses including air freight, rent-a-car, park-and-fly, and other airport-related businesses along the unused railroad right-of-way at its eastern edge. At the northern tip of this area is Day Square, a small commercial center of primarily airport- and auto-related businesses.

Non-local commercial uses in East Boston are predominantly airport-related. These include car rental agencies, parking lots, and freight forwarders. An airport-related commercial and industrial corridor parallels the railroad right-of-way and Route 1A through East Boston. Approximately 170 people are employed at 14 establishments in this area.

Business-related traffic to the airport is heavy. These firms benefit from much lower site costs than on-airport competitors while access to airline terminals is comparable.

Direct and uncomplicated access to the existing tunnels is essential for the car rental and parking firms. Because land zoned and located appropriately for these uses is limited, its value has been increasing in recent years to \$2.00-\$3.00 per square foot per year.

No major changes in the local economy are foreseen. Industrial uses are likely to remain marginal and oriented to low local wage rates. Industrial and/or vacant piers form a fringe along the southern and western edges of the community. These piers are a major area of redevelopment potential. There are also a number of underused or vacant publicly owned buildings which represent redevelopment potential.

Airport-related commercial uses have recently grown considerably in sales volume and may continue to do so, constrained primarily by the lack of land with suitable access to the airport and tunnels; property values for this type of land are likely to increase if the supply remains constant.

New residential and commercial development based on excellent views of the Harbor and Boston skyline has been proposed for waterfront sites. However, the market for such development is unproven, and its occurrence is uncertain. The Massport piers property on which new commercial development may occur is dependent on negotiations yet to be resolved between that agency, the community, and the BRA.

These and other proposed developments like the NDP II site, Maverick Square Post Office, and Lyman School are shown on Figure 13 and listed in Table 4.

3.2.11 Logan Airport

The project area includes portions of the Bird Island Flats development area, the Southwest Service Area, Central Area, and smaller portions of the Terminal Area and North Service Area (see Figure 13).

Activity at Logan Airport is related to airport passenger and cargo movements. Beyond these primary functions performed by the airlines, there are a range of airline-operated support activities, such as catering and maintenance, and several businesses oriented to airline passenger services, such as parking, car rental, concessions, and a hotel. A mixed-use development, providing office, manufacturing, and conference space for businesses oriented to air travel is proposed for Bird Island Flats, as is an air cargo and general aviation facility (see Figure 13).

Access to the regional highway system is critical to the operation of the airport. Over 7500 people are employed at the facility each day, and it receives more than 18,000 truck trips and 105,000 passenger vehicle trips per week. Because of its regional orientation, the airport and its supporting businesses are virtually self-contained and could operate at any location in the region; Logan's proximity to downtown Boston is an unusual advantage for a major hub airport. The relationship of the airport to its surrounding area is typical of large airports, with lower cost competitors occupying less costly space in East Boston and Revere, and airport employees residing disproportionately in North Shore communities from which automobile access is most convenient.

Airport land is leased from \$0.60 to \$1.00 per square foot per year with no taxes, but leasehold improvements are made by tenants, and commercial operations such as car rental agencies also pay a substantial portion of their revenues. This makes the airport location more costly than off-airport sites.

The future of the airport as a center of economic activity is likely to involve substantial growth in air cargo over the next 20 years. This is due to reliance on air travel and shipping by the high value added sectors of the regional economy such as computing equipment, instruments,

and bio-medical products. Passenger travel is forecasted to grow moderately during the same period, but such forecasts are uncertain owing to basic changes in the air travel industry. Continued reliance on automobiles, including rental cars, as the primary access mode to the airport is likely.

This growth would take place in a somewhat expanded terminal area; in new car rental and support facilities in the North and Southwest Service Areas; and on Bird Island Flats.

3.2.12 Route 1A North

This area consists of the land with frontage on Route 1A from Curtis Street in East Boston north to Bell Circle in Revere (see Figure 15).

Land uses are largely industrial or highway-oriented commercial, and most parcels are large, ranging upward from two to four acres. Some residential areas lie near the highway but are generally separated from it by differences in grade of ten to thirty feet.

Fuel storage, primary metals fabrication, and clothing manufacture are the principal industrial activities. Numerous airport- and highway-related activities, such as freight forwarding, commercial parking, gasoline stations, hotels, and restaurants are located here as well. Two major attractions which together draw over 3 million people per year are Suffolk Downs Thoroughbred Racetrack and the Wonderland Dog Track.

Approximately 310,000 vehicle trips per week are made over Route 1A North. The commercial activity which occurs in this area is predominantly a function of this traffic. There is very little interaction with the East Boston, Chelsea or Revere neighborhoods.

Major land uses in this area are shown in Figure 15 and listed in Table 4.

In the future, some infilling by industrial and airport-related uses such as freight forwarding operations will probably occur in this area. There will be an emphasis on airport-related uses.

3.3 NEIGHBORHOOD FACILITIES AND CHARACTERISTICS

Neighborhood characteristics and community facilities in the neighborhoods lying closest to the proposed tunnel alignments are described in this section.

Primary sources of information on population and housing are the U.S. Census of Population and Housing, the 1979 Boston Redevelopment Authority (BRA) Boston Household Survey, and BRA Neighborhood Profiles.

In the following sections the City of Boston is used as a baseline against which neighborhood change can be seen in perspective.

3.3.1 South End

General Characteristics

The South End was developed between 1858 and 1875 on newly filled land as a single-family rowhouse community for the relatively affluent. In the late 1800's, the neighborhood became a working class district of rooming houses and tenements and an enclave for immigrants. By the 1950's, population had started to decline rapidly, and in 1965 over 50 percent of the existing buildings were judged by the BRA to be in substandard condition.

Between 1950 and 1970 the total population of the South End decreased dramatically. The population of the South End in 1950 was 57,218; by 1960 the figure had declined 38.8 percent to 35,002. The South End suffered a further 35.2 percent population loss between 1960 and 1970, to a low of 22,680 people.

This trend was reversed in the years 1970-1980 when the South End population grew to 28,254, an increase

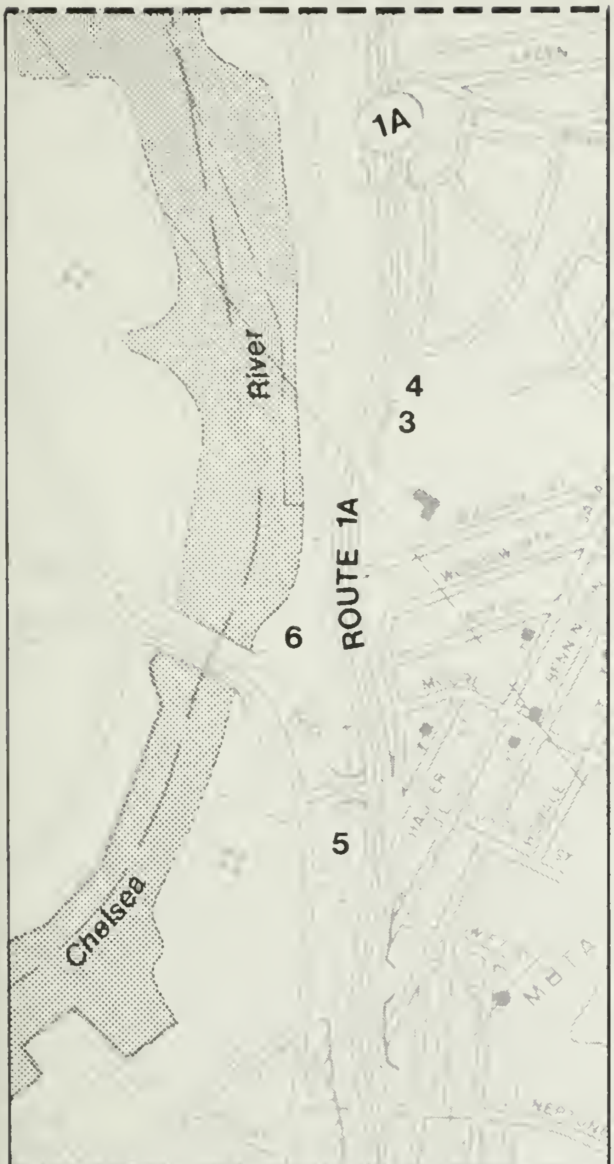


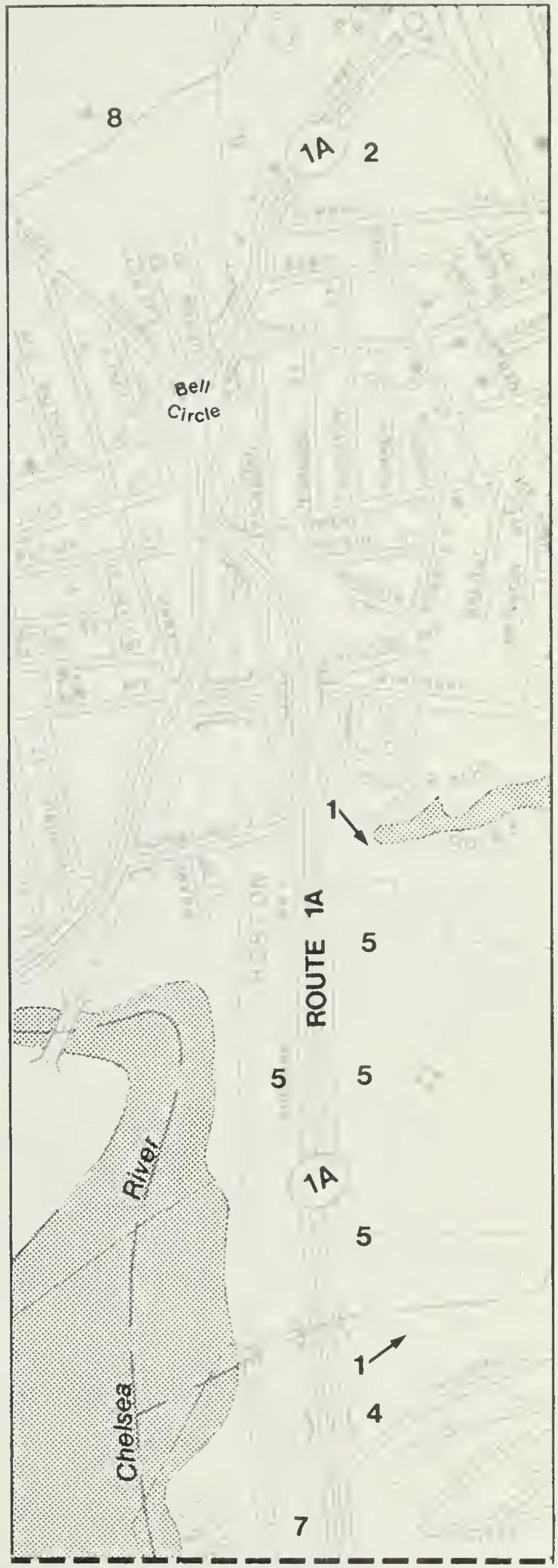
Figure 15
Route 1A North
Major Land Uses

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend

1 Suffolk Downs Race Track Entrances
2 Wonderland Race Track
3 Ramada Inn
4 Car Rental
5 Fuel Tank Farm
6 Bellesteel Fabricating Plant
7 P&L Sportswear
8 Towle-Leonard Factory



of 25 percent. The proportion of the population under age 18 decreased from 27 percent to 22 percent, a decrease of 19 percent in share; while the proportion of the population over age 65 decreased from 17 percent to 12 percent, a 29 percent decline in share.

The total number of housing units rose by 25 percent between 1970 and 1980, and the vacancy rate dropped from 18 percent to 12 percent. Rental units made up 87 percent of the 1980 housing stock, a 4 percent drop from 1970. Home values more than tripled between 1970 and 1980, and rents more than doubled. The average 1980 home value was $67,143 and the average rent was $184 per month.

According to a 1980 BRA Household Survey, the South End population has a broad ethnic mix. Only 67 percent of the residents speak English at home. The rate for Boston as a whole is 85 percent.

Project Study Area

The South End project area roughly includes the area bordered by Herald Street, the Central Artery/ Southeast Expressway, Massachusetts Avenue and Washington Street (see Figure 13). Its neighborhood characteristics differ not only within the project area boundaries, but also as compared to the South End as a whole or Boston as a whole.

The South End project area encompasses an industrial corridor and two large public housing projects which contain 46 percent of the project area's population. In 1980, 73 percent of the housing units in Boston were rental units; the rate for the project area was 95 percent. The widespread renovations which are occurring in other parts of the South End are evident only to a very limited extent in the project area.

The population of the South End project area decreased seven percent between 1970 and 1980, although in the section between East Canton and West Concord Streets, where some renovation is taking place, the population increased by 43 percent. Boston's population dropped 13 percent during this period. In 1980, 23 percent of the project area population was under age 18 and 15 percent was over age 62 (the proportions for the South End as a whole were 22 percent and 12 percent). The population in the two housing projects had unusually high concentrations of people under age 18. The areas experiencing renovation had significantly lower concentrations of people under age 18 and over age 62 (12 percent and six percent, respectively).

The 1980 average rent in the project area was $191, a 105 percent increase over 1970. The 1980 vacancy rate of 17 percent represented a 42 percent increase over the 1970 rate. The 1980 vacancy rate at the Cathedral Square Housing Project, located between East Brookline and Malden Streets (see Figure 13), was 38 percent, while the Castle Square Housing Development, located between Herald and East Berkeley Streets, had only a two percent vacancy rate in 1980.

The area south of East Concord Street is the only area with a significant number of owner-occupied homes, many of which have been renovated recently. Between 1970 and 1980, the average value of owner-occupied homes in this area increased from $14,700 to $61,300, an increase of 317 percent (the average 1980 value in Boston was $36,000, an 83 percent increase over 1970).

The residential neighborhoods of the South End do not share a cohesive district-wide civic structure or identity. Organized by geographically distinct neighborhood areas and block associations, there is relatively little social interaction between areas. Individual neighborhoods tend to have independent positions on issues, such as gentrification (the renovation of residential structures by persons of higher income than those already living in the area), which affect the South End as a whole.

Presently, there are nine active neighborhood associations and a dozen block associations and tenant councils. Each one tends to be relatively homogeneous in the ethnic and economic characteristics of its members.

Community Facilities

The South End project area contains very few community facilities; most of the facilities serving this area are located west of Washington Street.

The major community facilities located within the project area are identified on Table 5 and Figure 16.

3.3.2 South Boston

General Characteristics

South Boston's residential community encompasses the area stretching from Dorchester Avenue on the west to the Harbor on the east and south. (South Boston has been delineated on Figure 13 previously.) Its southern section is divided into six distinct neighborhoods, City Point, Telegraph Hill, Columbus Park, Andrew Square, West Broadway, and D Street; the project study area includes parts of the last three.

South Boston is a middle income neighborhood with residents of Irish descent making up 46 percent of the population. The area has long been a cohesive community. According to a 1980 BRA Survey, 93 percent of the residents have been raised as Catholics and only two percent of the population is non-white. The 1980 South Boston population of 30,372 was 25 percent less than the 1970 population. The proportion of the population under age 18 decreased by 26 percent and the proportion over age 62 increased by 25 percent between 1970 and 1980. The proportion of the 1980 population made up of these two age groups was 23 percent and 20 percent, respectively.

The number of housing units declined by only one percent during the period between 1970 and 1980. Rental units made up a consistent 74 percent of the total units during this period while the vacancy rate rose 125 percent to a 1980 rate of nine percent. Home values rose 121 percent while rents rose only 68 percent between 1970 and 1980. In 1980, the average home value was $25,328 and the average monthly rent was $129.

Project Study Area

The portion of South Boston within the project area is shown on Figure 17. It is roughly the area lying between G Street and the Central Artery/Southeast Expressway, from Southampton Street to Summer Street.

The South Boston project area experienced a much greater population decline between 1970 and 1980 than either South Boston as a whole or the City of Boston; the project area population dropped by 39 percent, compared to 18.6 percent for all of South Boston and 13 percent for Boston. This high rate of decline can be attributed partially to the D Street housing project where a number of units became vacant. The project area's proximity to the South Boston and South Bay industrial areas, which has made it susceptible to intrusions of truck traffic on local streets, has not made it an attractive location for renovation.

The percentage of the population under age 18 decreased by 35 percent between 1970 and 1980. Residents over 62 years of age compose an increasingly large share of the community; between 1970 and 1980, the proportion of residents over age 62 increased by 15 percent. This suggests a loss of young families from the area. (In Boston, the proportion of residents under age 18 decreased by 21 percent, and the proportion over age 62 remained stable during this same period.)

The vacancy rate in the project area quadrupled between 1970 and 1980. Rents increased by 42 percent, a rate slower than that for the City

Table 5

COMMUNITY FACILITIES IN THE PROJECT AREA (see Figure 16)

South End

Churches

1. Holy Trinity Roman Catholic Church.
2. Cathedral of the Holy Cross Roman Catholic Church

Parochial Schools

3. Cathedral Grammer School, (grades 1-8).
4. Cathedral High School. (grades 9-12).

Social Service and Other Facilities

5. St. Helena's House. (emergency housing).
6. Hello House. (alcohol rehabilitation).
7. South End Community Health Center, (medical services).
8. Pine Street Inn.
9. Harrison Fire Station.

Parks

10. Rotch Playground
11. Peter's Playground

MBTA Stations

12. Orange Line - Dover.
13. Orange Line - Northampton.

South Boston

Churches

1. St. Peter and Paul Roman Catholic Church.
2. St. Vincent de Paul Roman Catholic Church.
3. St. Augustine's Roman Catholic Church.
4. The Albanian Orthodox Church of St. John the Baptist.

Public Schools

5. Condon School. (grades K-5).
6. Gavin School, (grades 6-8).

Parochial Schools

7. St. Augustine School, (grades 1-8).
8. Cardinal Cushing High School for Girls, (grades 9-12).

Social Service Facilities

9. South Boston Community Health Center.
10. D Street Fire Station.
11. Boston Police Station 6.
12. Boy's and Girl's Club of Boston.

Parks

13. B Street/3rd Street Playground.

MBTA Stations

14. Red Line - Broadway.
15. Red Line - Andrew Square.

Chinatown/South Cove

Public Schools

1. Quincy Community School, (grades K-5).

Social Service Facilities

2. YMCA
3. Golden Age Center for the Elderly
4. South Cove Community Health Center.
5. Tufts New England Medical Center

Parks

6. Pagoda Park
7. Tai Tung Park
8. Chinese Gateway.

MBTA Stations

9. Orange Line - South Cove Station (opening 1986).

East Boston

Churches

1. Our Lady of the Assumption Church.
2. Most Holy Redeemer Church.
3. Our Lady of Mt. Carmel Church.
4. Sacred Heart Church.
5. St. Mary Star of the Sea Church.
6. White Street Baptist Church.
7. Our Saviour's American Lutheran Church.

Schools

8. Samuel Adams School, (grades K-5).
9. Donald McKay School, (grades K-6).
10. Dante Alighieri School, (grades K-5).
11. James Otis School, (grades K-5).
12. Patrick J. Kennedy School, (grades K-5).
13. Hugh Roe O'Donnell School, (grades K-5).
14. John Chevrus School, (grades K-5)
15. Joseph H. Barnes School, (grades 6-8).
16. East Boston High School.
17. Mario Umana School of Science and Technology, (grades 9-12).

Parochial Schools.

18. East Boston Central Catholic School, (grades pre K-8).
19. St. Mary Star of the Sea School, (grades 1-8).
20. St. Dominic Savio High School, (grades 9-12).

Social Service and Other Facilities.

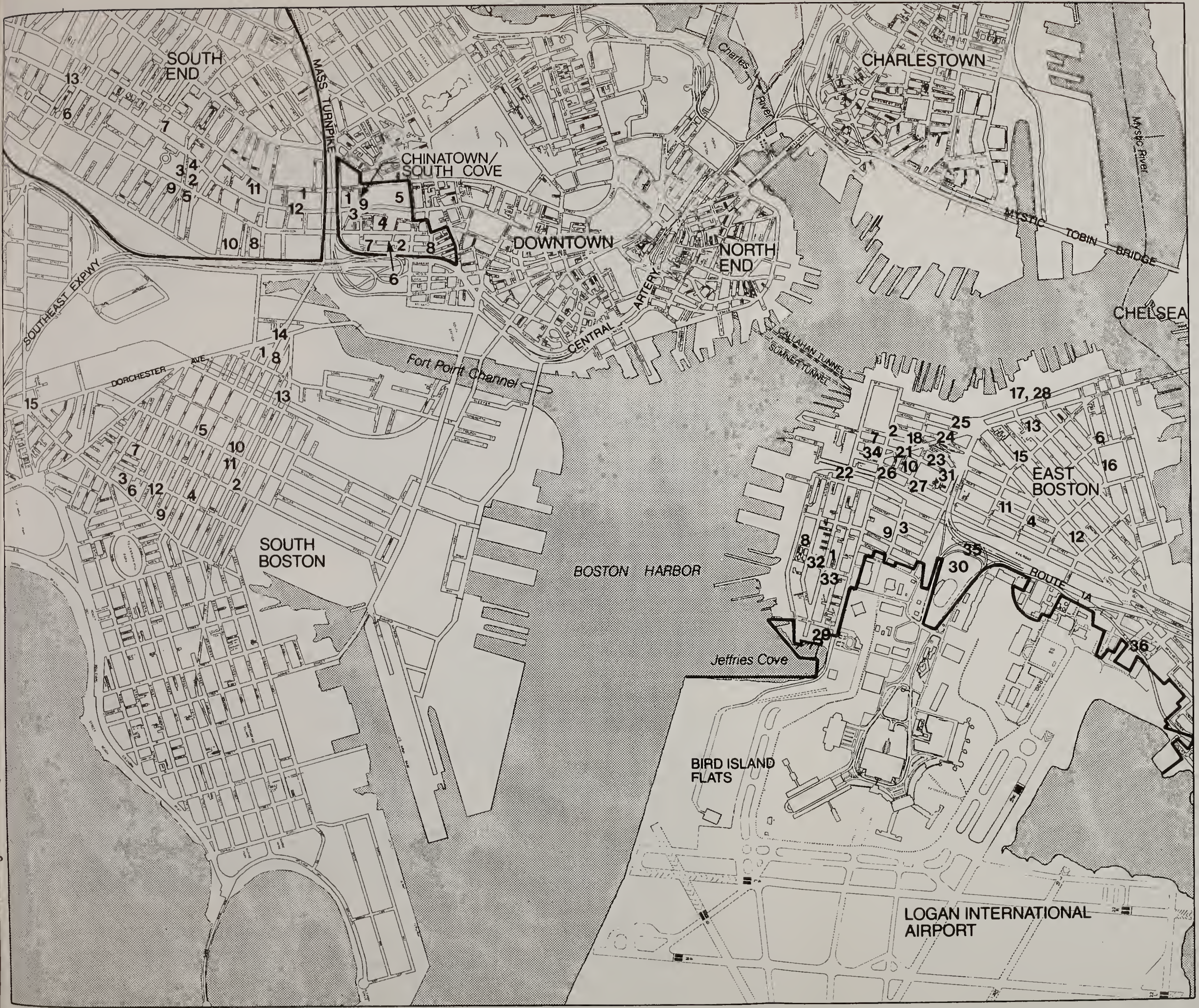
21. East Boston Police Station.
22. East Boston Fire Station.
23. East Boston Neighborhood Health Center.
24. East Boston Area Planning Action Council.
25. East Boston Social Centers, Inc.
26. Public Welfare Department Local Office.
27. Department of Social Services Local Office.
28. Harborside Community School.

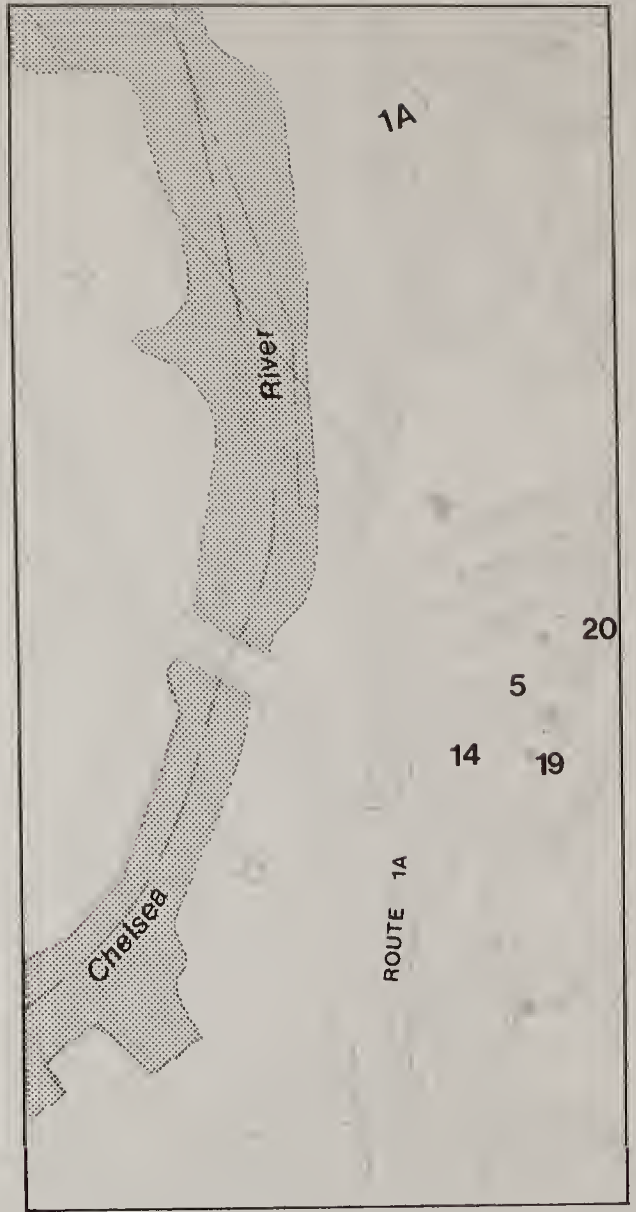
Parks

29. Porzio Park.
30. East Boston Memorial Stadium.
31. Paris Street Playground.
32. Brophy Park.
33. Sumner/Lamson Street Play Area.

MBTA Stations

34. Blue Line - Maverick Square.
35. Blue Line - Airport.
36. Blue Line - Wood Island.





Revere/Route 1A

Figure 16
Community Facilities

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend
Neighborhood Boundaries
1 Community Facilities Identified in Text

1 South End Census Tracts 704, 710, 711, 712 (1980)

2 South Boston Census Tracts 607, 608, 613, 614

3 Chinatown/South Cove BRA Study Area

4 East Boston Census Tracts 501-509, 512

Figure 17

Population and Housing Study Areas

0 800 1600 3200 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

as a whole (rents in Boston increased by 66 percent). The proportion of the total housing stock made up of rental units increased only slightly during this same period. The average value of owner-occupied homes increased 157 percent, compared to Boston's 83 percent increase. On average, homes in the study area, however, were still worth only 46 percent of the average value of homes in Boston during 1980.

The future of the South Boston project area will continue to be influenced to a great degree by the D Street housing project. Efforts by the Boston Housing Authority (BHA) are now underway to rehabilitate the project and return it to full occupancy and stability over the next five years. Probably second in importance to the influence of the D Street housing project is the effect of industrial land uses and through traffic on residential property values in the area. The MBTA improvements to Broadway Station, and planned local roadway and bridge improvements, may help to mitigate these problems, but continued efforts by the City and the community will be necessary to arrest the decline in property values in the area.

Community Facilities

The facilities in the project area are identified in Table 5 and in Figure 16.

3.3.3 Chinatown/South Cove

General Characteristics

Approximately 5,000 Asian-Americans reside in the district, making it the fourth largest Chinatown in the country. The continuous influx of Asian immigrants and the expansion of commercial and institutional land uses have placed severe pressure on the limited housing resources of the area. The unique character of the Chinatown/South Cove area adds to the diversity of the City and is a significant downtown tourist attraction.

Chinatown/South Cove is a fairly homogeneous neighborhood of low to middle-income Chinese. In the 1960's the area experienced a drastic decline in population due to a reduction of housing as a result of highway, institutional and urban renewal relocation and demolition. Recent relaxation of restrictions on Asian immigration has resulted in a substantial increase in immigrants from Taiwan, Hong Kong and Southeast Asia.

Although most immigrants live in families or are young, single people, the community has between four and five times as many households with elderly residents as the city as a whole. The area has a median family income considerably below that of the City as a whole: in 1970 it was $5100, compared to the citywide median of $9133. This may be partially accounted for by the high concentration of Chinatown/South Cove males in low-paying restaurant activities (77.3 percent) and women as stitchers in the garment industry (72.9 percent). Some residents are well educated and highly skilled, but are underemployed due to the language barrier. It is estimated that 60 percent to 80 percent of the Chinese population in this district does not speak English.

Approximately 78 percent of the housing in Chinatown is overcrowded; 72 percent of the housing was considered to be deteriorated or dilapidated in 1969 compared to a citywide figure of 14 percent.

The Chinatown/South Cove project area encompasses the entire Chinatown/South Cove neighborhood as delineated previously.

Community Facilities

Major community facilities in the area are listed in Table 5 and shown on Figure 16.

3.3.4 East Boston

General Characteristics

East Boston's residential population is a fairly homogeneous group with strong Catholic and Italian identities. According to a BRA Research Department survey, 57 percent of the neighborhood's population is of Italian origin; the next largest ethnic group is of Irish descent, with 17 percent of the population.

The population of East Boston dropped 17 percent to 32,178 between 1970 and 1980. The proportion of the population under age 18 dropped 29 percent and the proportion over age 62 rose 43 percent during this period. In 1980, 22 percent of the population was under age 18 and 20 percent was over age 62. This suggests a loss of young families from the area.

The number of housing units in East Boston increased by 6 percent between 1970 and 1980, with rental units representing approximately the same percentage of the total in 1970 as in 1980 (70-71 percent). The vacancy rate declined 13 percent during this period to a 1980 rate of 7 percent. Home values in 1980 were 100 percent higher than those of 1970, and rents were 83 percent higher than those of 1970. In 1980, the average home value was $29,749 and the average monthly rent was $132.

East Boston is one of Boston's less affluent neighborhoods. The BRA Survey showed that, in 1979, 34 percent of East Boston's households were classified as low income; (the rate for Boston as a whole was 22 percent). The large number of elderly residents on fixed incomes partially accounts for this low average income.

Project Study Area

The East Boston project area is roughly the area lying south of Curtis Street and bounded by Logan airport and Boston Harbor as shown in Figure 13.

In the East Boston project area, population decreased by 16 percent between 1970 and 1980; in some subareas, the population decreased by as much as 25 percent (Boston's population decreased 13 percent).

From 1970 to 1980 the percentage of the total population under age 18 decreased by 26 percent, and the percentage of the population over age 62 rose by 36 percent. The high average age of study area residents (31 years) reflects the area's large elderly population. The actual number of elderly residents increased by 15 percent, even though the total population declined. Although decreasing, the area has a slightly larger proportion of children than Boston as a whole. The proportions of the 1980 population under age 18 and over age 62 were 23 percent and 19 percent, respectively, for the East Boston project area and Boston as a whole.

Between 1970 and 1980, the number of housing units in the study area increased by 13 percent, while the vacancy rate increased from 8 percent to 12 percent. In some areas the vacancy rate went as high at 16 percent. Rents increased by 90 percent during this period, and the average value of owner-occupied homes increased by 116 percent. The rates in Boston were 66 percent and 83 percent, respectively. In 1980, rents and home values in the project area were still only about two-thirds as high as in Boston as a whole. The average 1980 value of an owner-occupied home was $24,176 (the Boston average was $36,000). The average 1980 rent was $122.

The project area in East Boston is a relatively stable community. A large percentage of the population was born in the community and has lived there ever since. The changes shown in the census and BRA statistics for the East Boston project area are broadly similar to those which occurred in Boston as a whole: the population decline is to a great extent the result of the natural aging process in the area's families and the outmigration of young people beginning families. However, this part of East Boston has an increasingly larger

older population, while the older population of the City as a whole is remaining stable. This suggests that in the next two decades there will be a relatively high potential for neighborhood change. This potential might lead either to increased housing vacancies or to some form of gentrification which might provide housing opportunities for the area's young people to set up their own households. The outcome will probably be influenced both by East Boston's amenities and by its environmental characteristics such as noise and air pollution, which vary significantly among East Boston neighborhoods.

Community Facilities

The service areas of the community facilities encompass several East Boston neighborhoods. The residential areas on each side of the railroad right-of-way are considered to be distinct neighborhoods by most residents--Central/Maverick to the west, Mt. Carmel and Jeffries Point to the east--but almost every community facility on either side of the railroad right-of-way is used by residents of both sides. This is true of schools, churches, social service agencies, recreational facilities, retail areas and places of employment.

The major community facilities in the East Boston project area are identified in Table 5 and in Figure 16.

Churches. As a predominantly Roman Catholic community, East Boston's parish churches are both gathering points for community activities and delineators of different neighborhoods. Most residents belong to the church whose parish includes their neighborhood, and the parish church is a focus for community identity. Church activities often draw people across parish lines and form community connections throughout East Boston.

In addition to the Catholic churches described above there are several Protestant churches in the Central/Maverick area. They draw their congregations from both within East Boston and from other communities.

Schools. The public schools in the East Boston project area are either neighborhood schools, which draw most of their students from the area around the school with little or no busing, or magnet schools, which draw their students from all of Boston and limit local enrollments to 25 percent of their student body. Many of the neighborhood schools have some magnet component within them so that there are very few schools whose students all come from the immediate vicinity.

Parochial Schools. The East Boston project area has three Catholic grammar schools which serve local neighborhoods and a high school which serves the region. They are attended by approximately 35 percent of the children in East Boston.

Social Service and Other Facilities. The majority of East Boston's public facilities and social service providers are located in the Central/ Maverick area. Most of the facilities are on the west side of the railroad right-of-way, but several, including the East Boston fire station, are on the Jeffries Point side of the railroad right-of-way.

A number of the facilities serve the general population of East Boston. These include the police and fire stations, the post office, the branch library, and the MBTA stations. Many facilities are particularly important to the special needs population, including the elderly, people dependent on social security or other public financial support, and those in need of particular physical or mental health care.

There are several elderly housing projects in the immediate vicinity of Maverick Square whose tenants are provided medical, social and other assistance by the agencies located in the Square.

The Central/Maverick area is

the primary retail shopping area for East Boston. This is true for both daily shopping needs and specialty items. Small convenience stores are found throughout the neighborhoods but the large grocery, stationary, clothing and general goods stores are found in Central Square. Shopping needs which cannot be met in the Central/Maverick area are filled outside of East Boston, generally in Chelsea or Revere.

3.4 EXISTING AIR QUALITY

3.4.1 Regional

Five pollutants are routinely monitored by the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Air Quality Control. Based on consultations with DEQE and the U.S. Environmental Protection Agency (EPA), however, it was determined that three of these, ozone, nitrogen dioxide (NO_2), and carbon monoxide (CO) would be examined in this study for purposes of defining the existing air quality in the Metropolitan Boston areas.

Measured air quality levels are compared with applicable standards to determine the quality of the air and the potential for adverse health effects. Both the National Ambient Air Quality Standards and the Massachusetts standards for CO, NO_2, and ozone are shown in Table 6. The intent of the primary standards is to protect the public health, while the intent of the secondary standards is to protect the public welfare from any known or anticipated effects.

In 1980, DEQE operated nineteen stations statewide to measure ozone. Sixteen of these stations reported violations of the one-hour ozone standard. This demonstrates the pervasiveness of and the continuing problem of ozone in this state. Table 7 shows the maximum one-hour ozone concentrations reported by a number of stations in the Metropolitan Boston area. Concentrations in excess of the standard were reported for sites in Medfield and Somerville. Monitoring sites in Medford and in East Boston near the Callahan Tunnel were discontinued in 1980 and their relatively low readings of maximum one-hour ozone may be a reflection of the limited number of observations. The site on Bremen Street in East Boston did not record any violation although the maximum one-hour reading was equal to the standard level of 0.12 parts per million (ppm).

DEQE monitored NO_2 at six stations in 1980. Four of these stations are located in Metropolitan Boston. The one-hour and annual mean concentrations for the Metropolitan area sites are also shown in Table 7. There is presently no short-term standard for NO_2. There is, however, a proposed EPA one-hour standard in the range of 470 to 940 micrograms per cubic meter (ug/m^3). When measured against this proposed standard, all maximum one-hour concentrations from these four stations are still below the more stringent limit of 470 ug/m^3. The state and federal annual standard for NO_2 is 100 ug/m^3. Although arithmetic means were reported, the limited amount of data collected in 1980 precludes a definitive assessment of violation of the annual standard at this time.

Thirteen CO monitoring stations were operated by DEQE in 1980. The maximum one-hour and eight-hour concentrations for the stations located in the Metropolitan Boston area are also presented in Table 7. No violation of the one-hour standard of 40 milligrams per cubic meter (mg/m^3) was reported anywhere; the highest one-hour concentration of 28.8 mg/m^3 was reported for a site at Washington Street in downtown Boston. Violations of the eight-hour standard of 10 mg/m^3 were reported at Kenmore Square, Callahan Tunnel, Washington Street, and Wellington Circle. Ten separate violations were recorded at the Callahan Tunnel site. The maximum eight-hour concentration at this site was 11.9 mg/m^3. These data suggest that violation of the eight-hour CO

TABLE 6

FEDERAL AND MASSACHUSETTS AIR QUALITY STANDARDS

Pollutant	Averaging Time*	Primary Standards+	Secondary Standards++
Carbon Monoxide	one-hour	40 mg/m^3 (35 ppm)	Same as primary
	eight-hour	10 mg/m^3 (9 ppm)	Same as primary
Nitrogen Dioxide	Annual**	100 ug/m^3 (0.05 ppm)	Same as primary
	one-hour++	470-940 ug/m^3 (0.25-0.50 ppm)	Not proposed as yet
Ozone	one-hour	240 ug/m^3 (0.12 ppm)	Same as primary

*Except for the annual standards, all standards are specified as not to be exceeded more than once a year.

++Standards are given in micrograms per cubic meter (ug/m^3), milligrams per cubic meter (mg/m^3), and in parts per million (ppm).

**Arithmetic mean.

++Proposed standard.

Table 7

MEASURED EXISTING AIR QUALITY IN THE METROPOLITAN BOSTON AREA IN 1980

OZONE:

Site Description	Comments	Max. One-hour	No. of Times > Std.*
E. Boston	On Bremen St.	0.120+	0
Medfield	N. Meadow St. SW of Boston	0.159	13
Medford	Rte. 16	0.079**	0
Somerville	Tufts University	0.140	5
E. Boston	Nr. Callahan	0.070**	0

NITROGEN DIOXIDE:

Site Description	Comments	Max. One-hour	No. of Times > Std.*	Arithmetic Mean
Boston	Kenmore Sq.	338++	-	93**
E. Boston	Callahan Tunnel	395	-	101**
Somerville	Tufts University	132	-	45**
E. Boston	On Bremen St.	197	-	61**

CARBON MONOXIDE:

Site Description	Comments	Max. One-hour	No. of Times > One hour Std.*	Max Eight-hour	No. of Times > Eight hour Std.*
Boston	Kenmore Sq.	16.1++	0	11.8	3
E. Boston	Callahan Tunnel	18.4	0	11.9	10
E. Boston	Bremen St.	9.2**	0	5.4**	0
Boston	Downtown, 600 Washington	28.8	0	13.9	2
Medford	Rte. 16	19.6	0	12.2	3
Somerville	Tufts University	6.9**	0	4.4**	0

*One-hour standard for ozone is 0.12 parts per million (ppm); proposed EPA one-hour NO_2 standard is 470 to 940 micrograms per cubic meter (ug/m^3); annual NO_2 standard is 100 ug/m^3; and the one-hour and eight-hour CO standards are respectively 40 and 10 milligrams per cubic meter (mg/m^3).

++Concentrations for ozone are given in ppm; for NO_2, in ug/m^3; and for CO, in mg/m^3.

**Limited number of observations.

standard can continue to be a problem in areas where local traffic congestion is present.

3.4.2 Local

To better define the existing conditions for the purpose of assessing the impact of the proposed project, a two-month continuous monitoring of CO at one site on Kneeland Street was conducted. This continuous monitoring was supplemented by a series of short-term measurements at a number of selected intersections or traffic congested areas that are expected to be affected by the proposed project. These areas are:

o Leverett Circle

o North End/Callahan Tunnel

o Dewey Square/South Station

o Bell Circle in Revere

The locations of the continuous monitor and the individual short-term measurement sites are shown in Figure 18.

Another area in the vicinity of the Sumner Tunnel portal in East Boston is known to have frequent high traffic congestion. This area was not selected for additional CO measurements, however, because there is sufficient historical data from a DEQE-operated monitoring site in this area to characterize the existing air quality at this location.

The methods and instrumentation used in the continuous monitoring of CO are approved by the EPA. Guidelines developed by the EPA were followed in both site selection and probe placement. Additionally, DEQE was involved in advising on the final selection of the monitoring sites and in the quality assurance and field audit of the instrumentation and measured results. Appendix 5 describes the various aspects of this field monitoring program in detail.

The results of the CO measurements are summarized in Table 8. Detailed descriptions of the results, along with sample strip chart recordings and tabulations of digitized data are given in Appendix 5. These results are highlighted below.

Table 8 shows the maximum 1-hour and 8-hour CO concentrations measured by the continuous monitor at Kneeland Street for the period 6 January through 29 March, 1982. The maximum recorded one-hour CO concentration at this site is 7 parts per million (ppm). This concentration is well under the corresponding standard of 35 ppm. The maximum eight-hour average CO concentration at this site is 4.4 ppm, which is also below the corresponding 9-ppm standard. No violation of either standard was recorded. In fact, the measured CO concentrations at Kneeland Street are generally quite low for an urban site. The frequency distribution of the one-hour CO measurements (see Appendix 5) indicates that about 99.9 percent of the time, the one-hour CO concentrations were less than or equal to 6.5 ppm, and about 90 percent of the time, they were less than or equal to 3 ppm.

Table 8 also summarizes the results of the short-term measurements conducted at Leverett Circle, the North End, Dewey Square, and Bell Circle. The short-term measurements at each site were taken during an approximately 12-hour period on two separate days. No violations of the one-hour standard were found. The highest one-hour CO concentration of 13.6 ppm was measured at the Quincy Market garage site (CT1). The Quincy Market site also reported the highest eight-hour average CO concentration of 9.2 ppm, which exceeds the corresponding standards of 9 ppm. No other violations of the eight-hour standard were found, although the Martha Way site (LC1) at Leverett Circle, and the Gibb's Service Station site (BC3) at Bell Circle, recorded eight-hour average concentrations that are very close to exceeding the standard.

The field measurements conduct-

Table 8

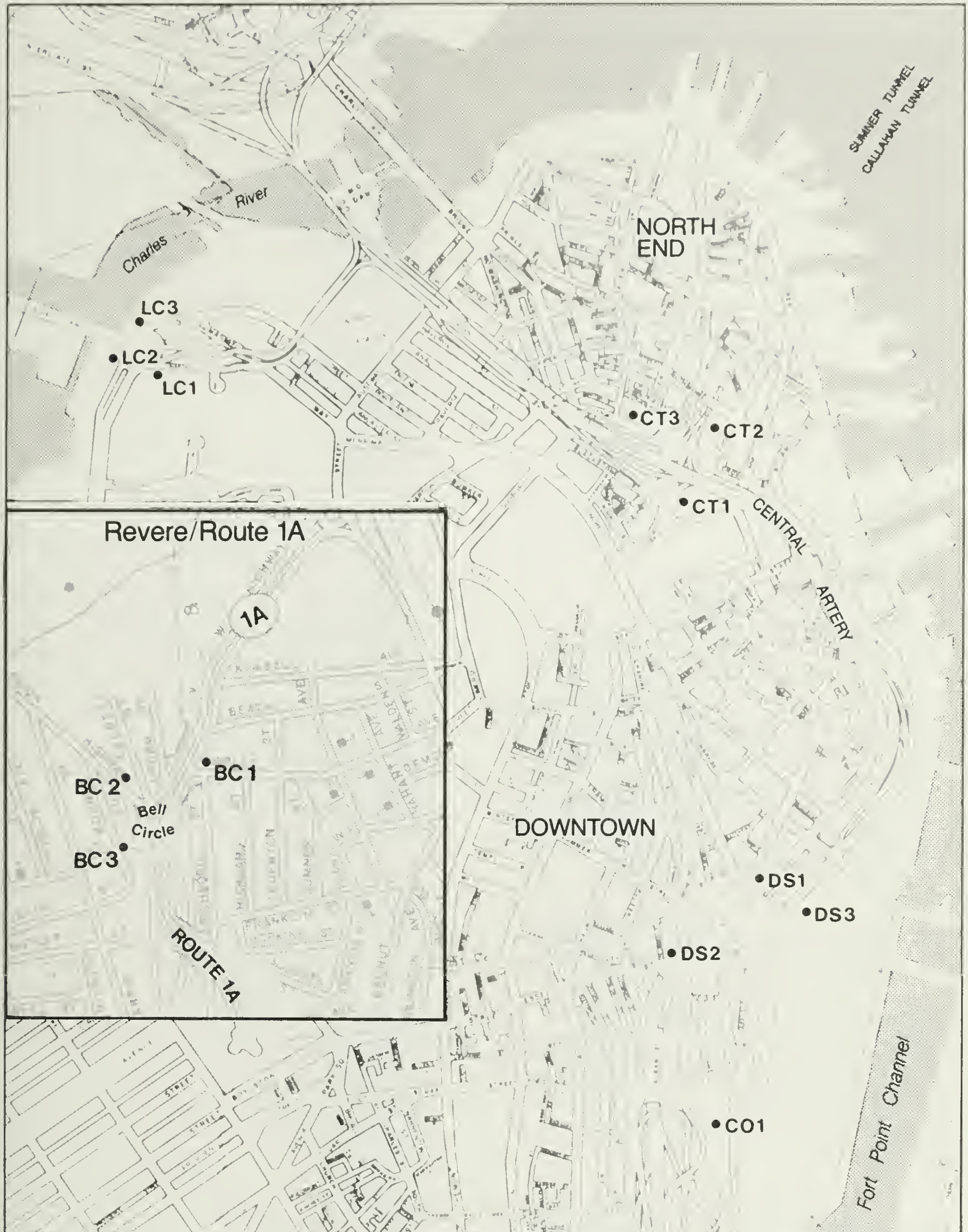
MEASURED CARBON MONOXIDE CONCENTRATIONS* (IN PPM)
FOR THE THIRD HARBOR TUNNEL STUDY AREA

Site ID**	Description	Period	Eight-Hour High	Eight-Hour Low	One-Hour High	One-Hour Low
CO1	Kneeland Street	01/06/82 through 03/29/82	4.4	0.5	7.0	0.5
	Leverett Circle++					
LC1	Martha Way	01/16/82 and 04/13/82	8.5/3.9	7.2/2.2	11.3/5.8	2.6/0.5
LC2	MDC Police Lot		3.7/5.4	3.4/4.1	5.7/6.6	1.4/3.1
LC3	DPW Parking		3.3/4.9	2.0/2.9	5.4/9.3	0.9/1.1
	North End/Callahan Tunnel++					
CT1	Quincy Market Garage	02/17/82 and 04/14/82	9.2/4.4	2.2/2.6	13.6/6.6	1.1/1.1
CT2	Fulton Street Parking		1.4/6.3	1.3/4.1	3.6/8.0	0.5/3.8
CT3	Hanover/Cross Street		7.6/3.5	5.2/2.7	9.5/5.9	3.0/0.5
	Dewey Square++					
DS1	Purchase Street	02/18/82 and 04/15/82	4.6/3.2	3.4/1.8	8.2/7.3	2.0/0.8
DS2	Lincoln/Essex Parking		6.1/2.4	4.0/2.0	8.1/4.4	2.4/0.5
DS3	Federal Reserve Bank		3.7/4.9	2.9/3.1	6.3/6.0	1.3/0.9
	Bell Circle++					
BC1	Dunkin Donuts	02/19/82 and 03/26/82	7.0/4.4	2.3/3.0	7.4/5.4	0.3/1.4
BC2	Kappy's Parking		5.1/3.0	3.3/2.6	7.8/3.7	1.1/1.7
BC3	Gibb's Service Station		9.0/3.7	1.7/0.8	10.5/4.6	3.7/0.6

*The one-hour and eight-hour standards are respectively 35 and 9 ppm.

**Refer to Figure 18 for the location of these sites.

++Data for the two days of short-term monitoring at Leverett Circle, the North End, Dewey Square, and Bell Circle are reported separately. For example, the eight-hour concentrations of 8.5/3.9 for the Martha Way site refer to the maximum eight-hour concentrations for this site on 16 February and 13 April, 1982, respectively.



LC – Leverett Circle
CT – Callahan Tunnel/North End
DS – Dewey Square/South Station
CO – Kneeland Street
BC – Bell Circle (see inset)

Figure 18
Carbon Monoxide Measurement Locations

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

ed continuously at Kneeland Street and intermittently at Leverett Circle, the North End, Dewey Square, and Bell Circle suggest that existing 1982 one-hour CO concentrations would probably be well under the standard. However, maximum eight-hour concentrations could exceed the 9-ppm standard in a number of locations in the study area where traffic congestion is severe.

For the purposes of the air quality analysis for this study, the following CO background concentrations will be used:

Year	One-Hour	Eight-Hour
1982	4.0 ppm	3.2 ppm
1990	2.1 ppm	1.7 ppm
2010	1.6 ppm	1.3 ppm

3.5 NOISE AND VIBRATION

3.5.1 Existing Noise Levels

Noise-sensitive land uses in the project area include residences, churches, schools, and parklands. The existing noise environment at these locations is generally dominated by motor vehicle traffic on expresssways, major arterials or local streets, and in some cases by aircraft operations associated with Logan Airport.

The basic noise unit employed in this study is the decibel (dBA). The decibel is used to measure the relative noisiness of sounds; for example, a 3-dBA increase in noise level can just barely be perceived, while a 10-dBA increase corresponds to a subjective doubling of loudness. The relationship between changes in noise level and loudness is indicated in Table 9.

Since noise fluctuates from moment to moment, it is common practice to condense all this information into a single number, called the Equivalent Noise Level (L_{eq}). Many surveys show that the L_{eq} properly predicts annoyance, and thus this descriptor is commonly used for noise measurements, prediction, and impact assessment. As prescribed by FHWA, the Hourly Equivalent Noise Level for the noisiest traffic hour is used throughout this document to assess roadway noise impact. The FHWA noise criteria are summarized in Table 10. Noise abatement must be considered if project noise exceeds the noise abatement criteria based on activity category, or if the project will substantially increase the noise level at sensitive locations.

Noise measurements were made at 14 locations within the project area during May of 1982 in order to document the existing noise environment. These locations are shown in Figure 19 and are described in Table 11. At locations 1-13, short-term measurements were made in order to determine the existing daytime hourly L_{eq} at representative noise sensitive receptors. These receptors were chosen so as to include residences, institutions, and parks closest to project roads. At location 14, near the Sumner/Callahan Tunnel toll plaza, the Hourly L_{eq} was monitored over a 24-hour period. The purpose of this latter measurement was to aid in the prediction of noise from the proposed Third Harbor Tunnel Toll Plaza facilities.

The results of the existing noise measurement program are summarized in Table 11. These results indicate hourly daytime L_{eq} ranging from a low of 57 dBA to a high of 73 dBA at noise sensitive locations; such levels are typical for a daytime urban environment. Existing noise levels are observed to exceed the FHWA exterior noise criterion (67 dBA for Activity Category B) at about half of the measurement locations. Since aircraft noise is significant at some locations in the project area, measurement results in Table 11 are provided for each location both with and without noise contribution from aircraft sources. In most instances, however, the increase in noise due to aircraft operations was measured to be less than 3 dBA, and therefore aircraft noise was not significant for most of the measurements.

Figure 19
Existing Noise Measurement Locations

EIS/EIR for I-90, The Third Harbor Tunnel

Table 9

RELATIONSHIP BETWEEN CHANGES IN NOISE LEVEL AND LOUDNESS

Increase (or Decrease) in Noise Level	Loudness Multiplied (or Divided) by
3 dBA	1.2
6 dBA	1.5
10 dBA	2
20 dBA	4

Table 10

FHWA NOISE CRITERIA

NOISE ABATEMENT CRITERIA:

Activity Category	L_{eq} for Noisiest Traffic Hour	Description of activity category
A	57(Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.
B	67(Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72(Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52(Interior)	Residences, motels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

CRITERIA FOR INCREASE IN NOISE LEVEL:

Increase (dBA)	Subjective Descriptor
0 - 5	No impact
5 - 10	Minor impact
10 - 15	Moderate impact
Greater than 15	Serious impact (substantial)

Table 11

SUMMARY OF EXISTING NOISE MEASUREMENTS

Site* No	Description	Daytime Hourly L_{eq} With Aircraft	Daytime Hourly L_{eq} Without Aircraft
1	Lester J. Rotch Playground: Approx. 120 ft. from ℄ Albany St.	69	69
2	St. Peter & Paul Church: Approx. 90 ft. from ℄ Dorchester Ave.	N.A.	63
3	Dockside Place Condominiums: 15 Sleeper St. (6th floor)	73	72
4	Boston Tea Party Museum: Approx. 100 ft. from ℄ Congress St.	65	64
5	Rear of No. 74-75 Frankfort St: Approx. 100 ft. from Orleans St.	57	55
6	Front of No. 120-122 Bremen St. (Between Porter St. & Gove St.)	68	68
7	Corner of Bremen St. & Porter St. (Near Residential Bldg.)	73	73
8	Front of Open Lot on Bremen St. (Between Marion St & Brooks St.)	69	67
9	Front of Open Lot on Bremen St. (Between Brooks St. & Putnam St.)	68	68
10	East Boston Recreation Area (At home plate of West Baseball Field)	65	61
11	East Boston Recreation Area (At home plate of East Baseball Field)	67	66
12	Front of No. 347 Maverick St. (Between Ardee St. & Lamson St.)	64	58
13	Porzio Park (Jeffries Point - East Boston)	69	62
14	Callahan/Sumner Tunnel Toll Plaza (Tpke. Authority Parking Lot)	**	--

*See Fig. 19.
**See Table 12.

Table 12 lists the hourly L_{eq} values measured over a 24-hour period next to the Callahan/Sumner Tunnel toll plaza (location 14). These levels were observed to vary between 62 dBA and 79 dBA, dominated by noise from accelerating vehicles. Traffic counts were also obtained for each measurement hour in order to calibrate the standard roadway noise prediction model for the special situation of a toll plaza facility. Details relating to noise descriptors, measurement methodology and prediction methods are provided in Appendix 6.

3.5.2 Existing Vibration Levels

Vibration-sensitive land uses in the project area also include residential, commercial, instituional, and industrial buildings as well as existing MBTA subway tunnel structures. Concerns about vibration at such locations are related to potential structural damage, annoyance to building occupants, and/or interference with sensitive manufacturing processes.

The basic vibration descriptor employed in this study is the Peak Velocity, expressed in "inches per second" (in./sec). This descriptor refers to the largest value of the velocity of a body's surface that occurs during the motion of that body (e.g., the ground, a building or tunnel component, etc.). The Peak Velocity has been found to relate well to structural damage, human viration perception, and interference with operation of very sensitive optical equipment. For example, vibration with a Peak Velocity of 0.005 in./sec would be just barely perceptible and could be disruptive to the operation of some sensitive precision instruments. Vibrations that are 10 times greater than the perception threshold, i.e., 0.05 in./sec, would be characterized as strongly noticeable, while vibrations that are 100 times the perception threshold, i.e., 0.5 in./sec, would be characterized as very unpleasant. Vibrations that are 1000 times the perception threshold, i.e., 5 in./sec, would begin to become intolerable to humans and would be likely to cause minor structural damage to buildings. Vibration criteria used in this study are summarized in Table 13.

Vibration measurements were made during April and June of 1982 in order to document the existing vibration environment at four vibration-sensitive receptors within the project area (see Figure 20). These included a residential area located above the MBTA Blue Line Tunnel in East Boston (site A), the MBTA Red Line Tunnel below Fort Point Channel (site B), the MBTA Blue Line Tunnel in East Boston (site C), and the Gillette Co. facilities in South Boston (site D).

The results of ground vibration measurements near Bremen Street in East Boston (site A on Figure 22) indicate peak vertical ground vibration velocities ranging between 0.02 and 0.06 in./sec during subway train passages in the MBTA Blue Line tunnel below. These values are representative of existing vibrations experienced by some residences in this area. Inside buildings directly above the subway tunnel, higher vibrations may actually occur due to amplifications resulting from floor and wall resonances. On the other hand, lower vibration levels would occur at increasing distances from the tunnel. In spite of these variations, these results serve as a useful reference for comparison with project-generated vibration.

Vibration measurements made inside existing MBTA subway tunnels at two locations which intersect the proposed Third Harbor Tunnel alignments (sites B and C on Figure 20) indicated that vibrations due to train passages are lowest on the tunnel ceiling. These vibration measurements will be used to determine impact, since they represent the smallest existing vibrations and since the ceiling is likely to be the part of the tunnel structure most susceptible to damage. Therefore, these results serve as a useful baseline for comparison with future project-

Table 12

VARIATION OF HOURLY L_{eq} OVER A 24-HOUR PERIOD* AT THE CALLAHAN/SUMNER TUNNEL TOLL PLAZA+

Hour of Day	Hourly L_{eq} (dBA)
Midnight - 1 a.m.	68
1 a.m. - 2 a.m.	65
2 a.m. - 3 a.m.	62
3 a.m. - 4 a.m.	65
4 a.m. - 5 a.m.	65
5 a.m. - 6 a.m.	68
6 a.m. - 7 a.m.	71
7 a.m. - 8 a.m.	71
8 a.m. - 9 a.m.	71
9 a.m. - 10 a.m.	73
10 a.m. - 11 a.m.	79
11 a.m. - 12 Noon	74
12 Noon - 1 p.m.	75
1 p.m. - 2 p.m.	74
2 p.m. - 3 p.m.	75
3 p.m. - 4 p.m.	71
4 p.m. - 5 p.m.	71
5 p.m. - 6 p.m.	70
6 p.m. - 7 p.m.	69
7 p.m. - 8 p.m.	68
8 p.m. - 9 p.m.	70
9 p.m. - 10 p.m.	72
10 p.m. - 11 p.m.	71
11 p.m. - Midnight	70

*14 May 1982.

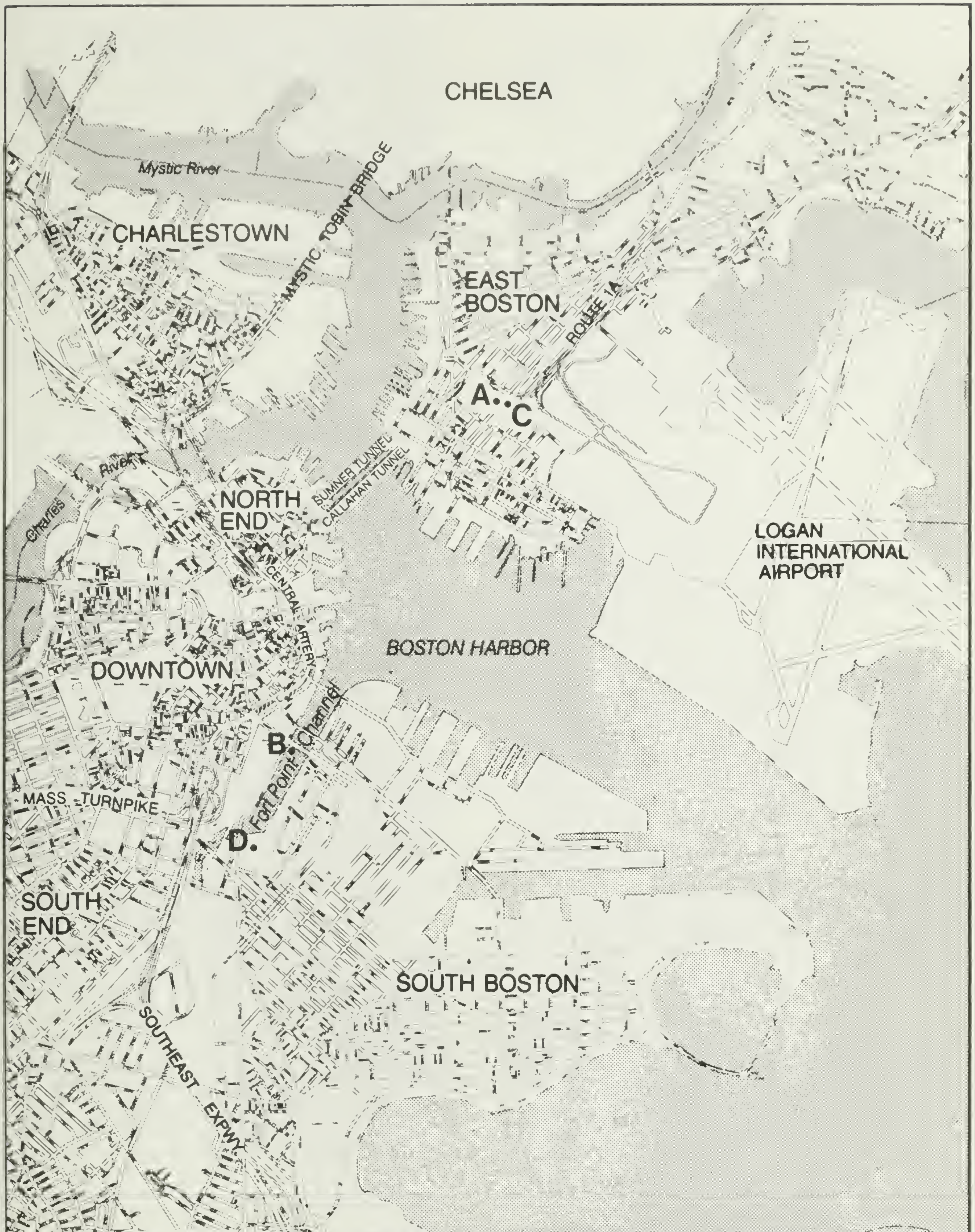
+Measurement Site No. 14 (See Fig. 19).

Table 13

VIBRATION CRITERIA

Type of Effect	Maximum Peak Vibration Velocity (in./sec)
Damage Effects	
Structural Damage	1.9
Architectural Damage	
-Historical Buildings	0.08
-Non-Historical Residential Buildings	0.2
Annoyance Effects	
Hospital and Critical Areas	0.005
Residential/Institutional/Hotel	
-Construction Period	0.01
-Long Term	0.007
Office	0.02
Factory	0.04

*Maximum existing vibrations serve as supplementary criteria to the values listed in this table.



A – 144 Bremen St., Above the Blue Line Subway Tunnel

B – Fort Point Channel, Above the Red Line Subway Tunnel (southbound)

C – Porter Street, Above the Blue Line Subway Tunnel

D – Gillette Company

Figure 20
Vibration Measurement Locations

EIS/EIR for I-90, The Third Harbor Tunnel

generated vibrations. At site B, peak vibration velocities were measured in a direction perpendicular to the MBTA Red Line tunnel ceiling surface at a tunnel cross-section beneath Fort Point Channel. Train speeds ranged between 18 mph and 34 mph and peak ceiling vibration velocities ranged between 0.014 in./sec and 0.042 in./sec at this location. Similar measurements were made at site C, inside the MBTA Blue Line Tunnel beneath Porter Street in East Boston. For these measurements, train speeds ranged between 17 mph and 37 mph while peak ceiling vibration velocities ranged between 0.016 in./sec and 0.095 in./sec.

Vibration measurements were also performed at the Gillette Company facilities in South Boston (site D on Figure 20) in order to document existing levels of building vibration at 11 locations near potentially sensitive equipment. Vibration-sensitive equipment included electron microscopes, metalographs, grinding machines, surface analyzers, blade sharpeners, hardness testers, and scales. Measurement results indicate maximum values of peak vertical floor vibration velocities ranging between 0.004 in./sec and 0.031 in./sec, with the greatest vibrations occurring in the building closest to the Fort Point Channel. Details relating to the vibration measurement methodology and results are provided in Appendix 6.

3.6 WATER RESOURCES

This section summarizes data concerning the physical, chemical, and biological oceanographic environment in the project area. Also included is a discussion of industrial users of the water of Fort Point Channel and nearby parts of Boston Harbor. The data were obtained from investigations conducted during 1982. Detailed results of the field studies are contained in Appendix 7.

The Massachusetts Division of Water Pollution Control (DWPC) has classified Boston Inner Harbor as Class SC. Class SC waters are to be suitable for aesthetic enjoyment, the protection and propagation of marine life, and secondary contact recreation. Specific water quality standards applicable to SC waters include a minimum dissolved oxygen concentration of 6.0 milligrams/liter (mg/l), a pH range of 6.5 to 8.5, and maximum fecal coliform bacteria count of 1000 organisms per 100 milliliters of sample.

3.6.1 Fort Point Channel

Tides and Currents

The tidal water area of the Fort Point Channel upstream of the Northern Avenue Bridge is 2.26 million square feet (approximately 52 acres). Since the sides of the Channel are, for all practical purposes, vertical, consisting of revetments and bulkheads, there is no real difference in area between high tide and low tide. The Channel is approximately 5600 feet in length, approximately 560 feet wide at its mouth, and the length of tidal excursion is approximately 2100 feet. (Tidal excursion represents the distance a particle of water will travel on an ebb or flood tide.) The mean tidal prism (water volume between mean low and mean high tide) is 21.5 million cubic feet while the spring tidal prism is 24.9 million cubic feet. As in other Harbor areas, the height of the spring tide (the spring tide generally occurs every two weeks when the moon is new or full) is approximately 11 feet while the mean high tide height is 9.5 feet. Computations indicate that the Channel is flushed once in every 2.1 full tide cycles (approximately every 26 hours). Computations also indicate that the average current velocity of water entering or leaving the Channel at the Northern Avenue Bridge is approximately 0.09 feet per second (fps).

Water Quality

Water quality conditions in the Fort Point Channel are highly variable. During non-storm conditions, water quality is similar to that of

the Inner Harbor (Table 14). However, during storms, combined sewer overflows contribute high levels of bacteria, solids, biochemical oxygen demand, nutrients, and metals to the water, and cause violations of Class SC water quality standards. Water in the Fort Point Channel is, however, suitable for fish and other marine life, boating, and industrial cooling water. Figure 21 presents the locations of water quality sampling sites in Boston Harbor.

Sediments

Figure 22 shows locations of site-specific sediment sampling locations.

The chemical and physical conditions of bottom sediments in the Fort Point Channel were determined through a review of existing data as well as site-specific investigations. These show high levels of metals and petroleum residuals in the Channel.

All surface sediments in the Channel are found to be Category 3 (highly contaminated) quality, with the most contaminated area located between Dorchester Avenue and Summer Street. While the quality of surface sediments is significantly degraded, this condition is only found in the upper 2-3 feet. Below this depth, sediments are relatively uncontaminated, and most are of Category 1 (uncontaminated) quality. The sediment quality at various depths at Station FP-2, as an example, is shown in Figure 23. Extraction Procedure Testing on Fort Point Channel sediments indicated they are non-hazardous, including no hazardous levels of PCBs. A summary of sediment characteristics is presented in Table 15.

Marine Life

Marine life found in the Fort Point Channel includes flounder, stickleback, mummichog, smelt, alewife, eel, and others which may enter the Channel from the Harbor. The diversity of marine life living in the bottom sediments is low, with a high preponderance of pollution-tolerant worms. Filamentous algae are the dominant species of marine vegetation in the Channel.

3.6.2 Boston Inner Harbor

Tides and Currents

Measurements of current speed and direction were conducted at four locations on a spring (high) and neap (low) tide cycle during March, 1982. The results of the measurements indicated peak velocities of one fps during spring tides. The predominant average velocities, however, ranged from 0.20 to 0.24 fps. The higher current velocities occurred near the surface during ebb tide. However, during flood tide, the higher current velocities were found to occur in the middle and bottom of the water column. The variations may be due to freshwater discharges from the Charles and Mystic Rivers.

Computations indicate that water within the project area will travel approximately 4500 feet on the ebb tide and approximately 6400 feet on the flood tide. The excursion distance from the project corridors are shown in Figures 24 and 25.

Water Quality

Existing water quality information on the Harbor indicates that Class SC standards are not consistently met. In past and present monitoring programs by both Massport and the Massachusetts Division of Water Pollution Control, dissolved oxygen concentrations in Inner Harbor water have been lower than the minimum 6.0 mg/l required for Class SC water. Existing water quality data are summarized in Table 14, above.

Freshwater discharges from the Charles and Mystic Rivers can have a marked effect on salinity of the Inner Harbor. Water quality of the Inner Harbor, particularly for such parameters as bacteria, suspended solids, nutrients, and metals, is significantly affected during storms when the

Table 14

WATER QUALITY SUMMARY BOSTON INNER HARBOR
(mg/l)

Parameter	Maximum	Minimum	Average
pH[1]	8.0	7.6	7.8
Suspended Solids[1]	35.0	16.0	22.0
Oil and Grease[1]	2.6	0.0	1.3
Total Kjeldahl Nitrogen[1]	2.4	0.64	1.23
Ammonia Nitrogen[1]	0.19	0.01	0.07
Sulfate[1]	3,325	1,950	2,488
Total Phosphorus[1]	0.10	0.02	0.05
Conductivity[1] (μmhos/cm)	40,000	34,000	38,800
Total Coliform[1] (# organisms/100 ml)	2,400	230	711[3]
Fecal Coliform[1] (# organisms/100 ml)	380	20	105[3]
Chloride[1]	14,000	11,000	13,300
Arsenic[2]	<0.001	-	<0.001
Cadmium[2]	0.014	0.0005	0.009
Chromium[2]	0.004	-	<0.004
Copper[2]	0.01	0.0014	0.006
Lead[2]	0.017	0.002	0.012
Mercury (μg/l)[2]	0.05	0.005	0.035
Nickel[2]	0.02	0.004	0.016
Silver[2]	<0.08	-	<0.08
Vanadium[2]	<0.04	-	<0.04
Zinc[2]	0.145	0.002	0.05
Dissolved Oxygen[1]			
Surface	8.5	5.2	7.2
Middle (13'-18')	6.8	5.4	5.9
Bottom (26'-40')	6.8	3.4	5.5

Sources:

1 Massachusetts Department of Environmental Quality Engineering from sampling locations BH03 (Boston Inner Harbor north of mouth of Charles River near U.S. Naval Reserve), BH04 (tidal portion of Charles River downstream of Charlestown Bridge) and BH05 (Main Channel of Boston Inner Harbor near mouth of Fort Point Channel) surveyed July 14-15, 1982, Personal Communication.

2 U.S. Army Corps of Engineers, 1981 and Massport Seaport Development, 1980.

3 Geometric mean of DWPC Data

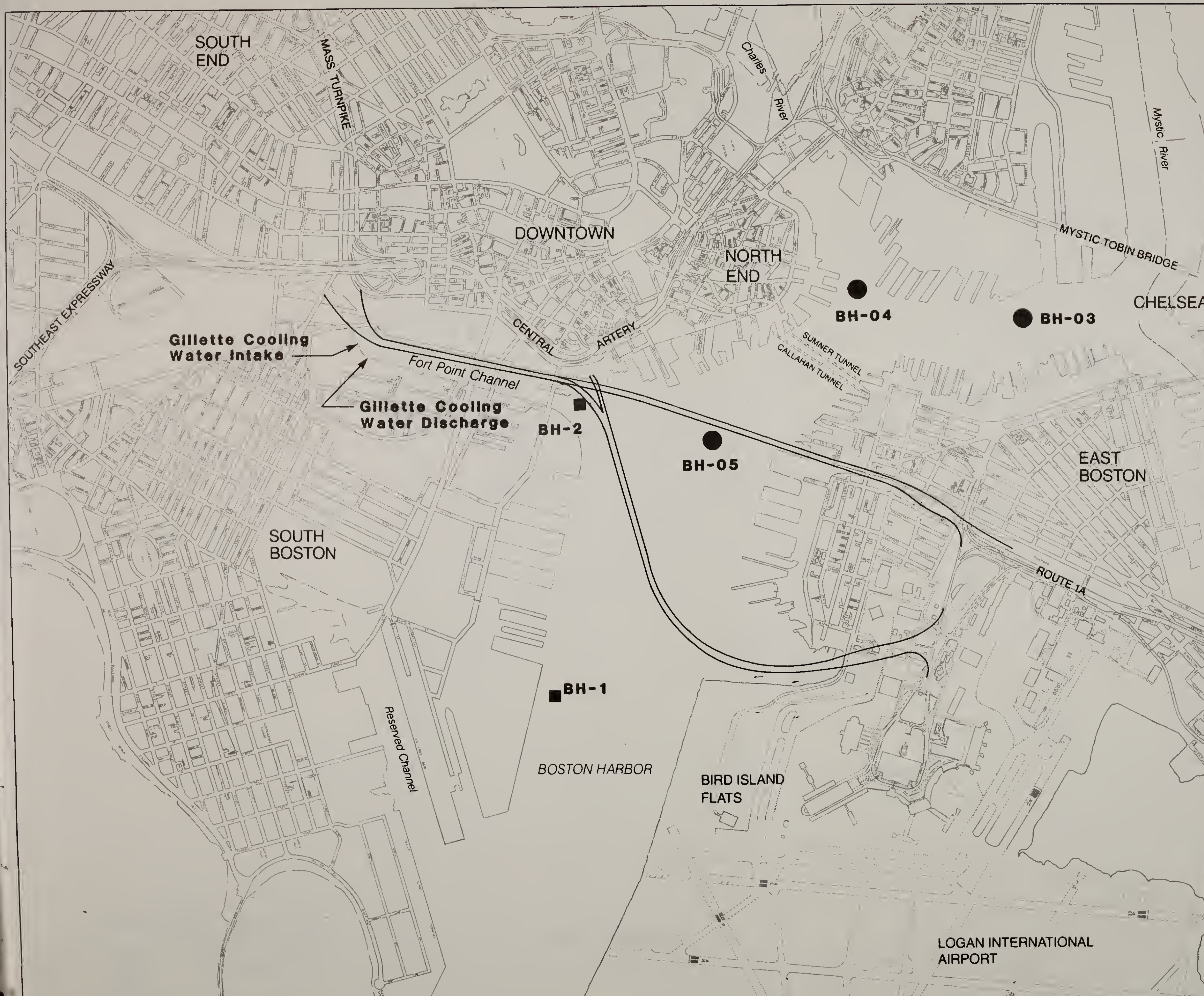


Figure 21
Water Quality Sampling Locations

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend
■ Massport Station
● DWPC Station

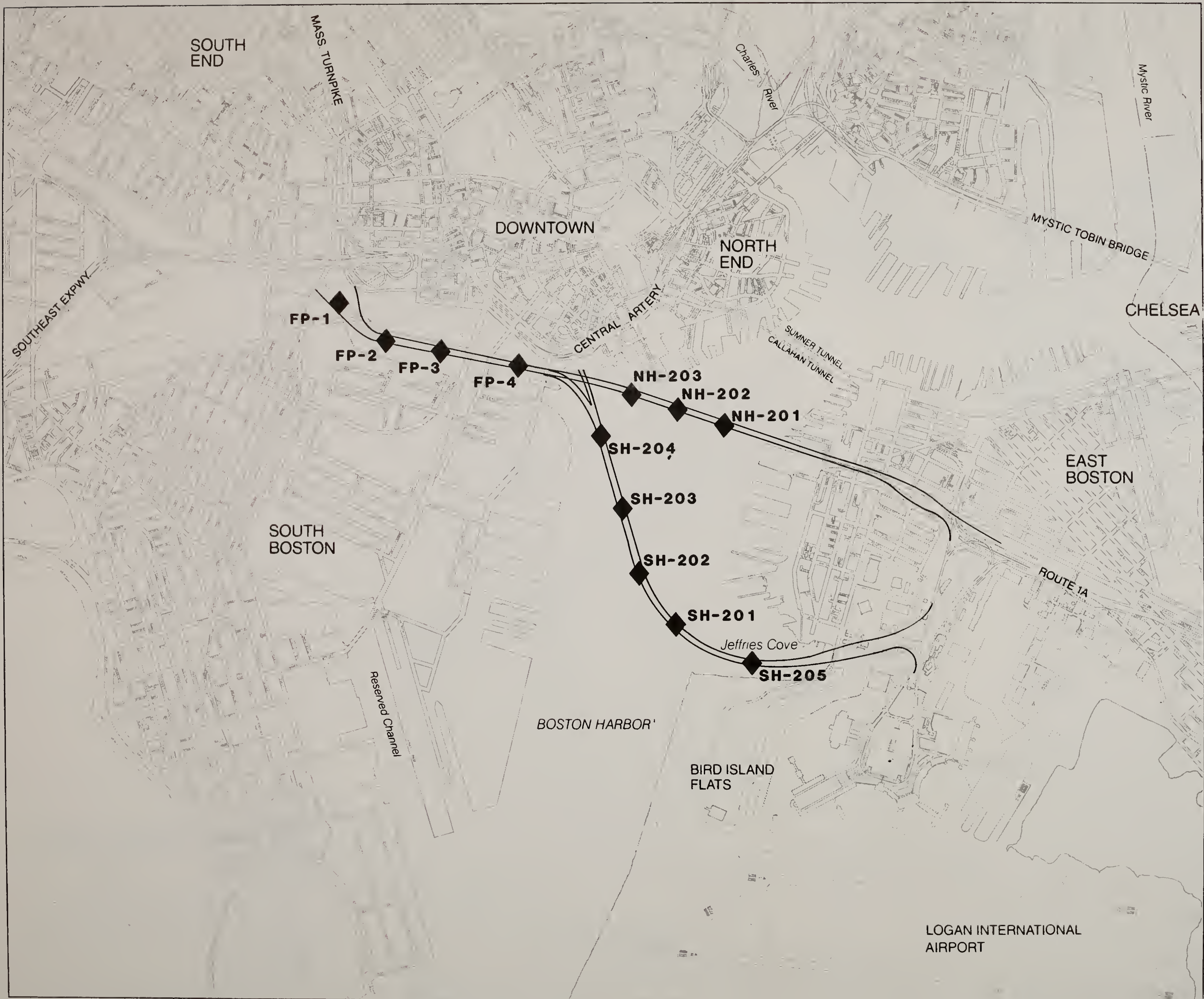


Figure 22
Third Harbor Tunnel Sediment Sampling Locations

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

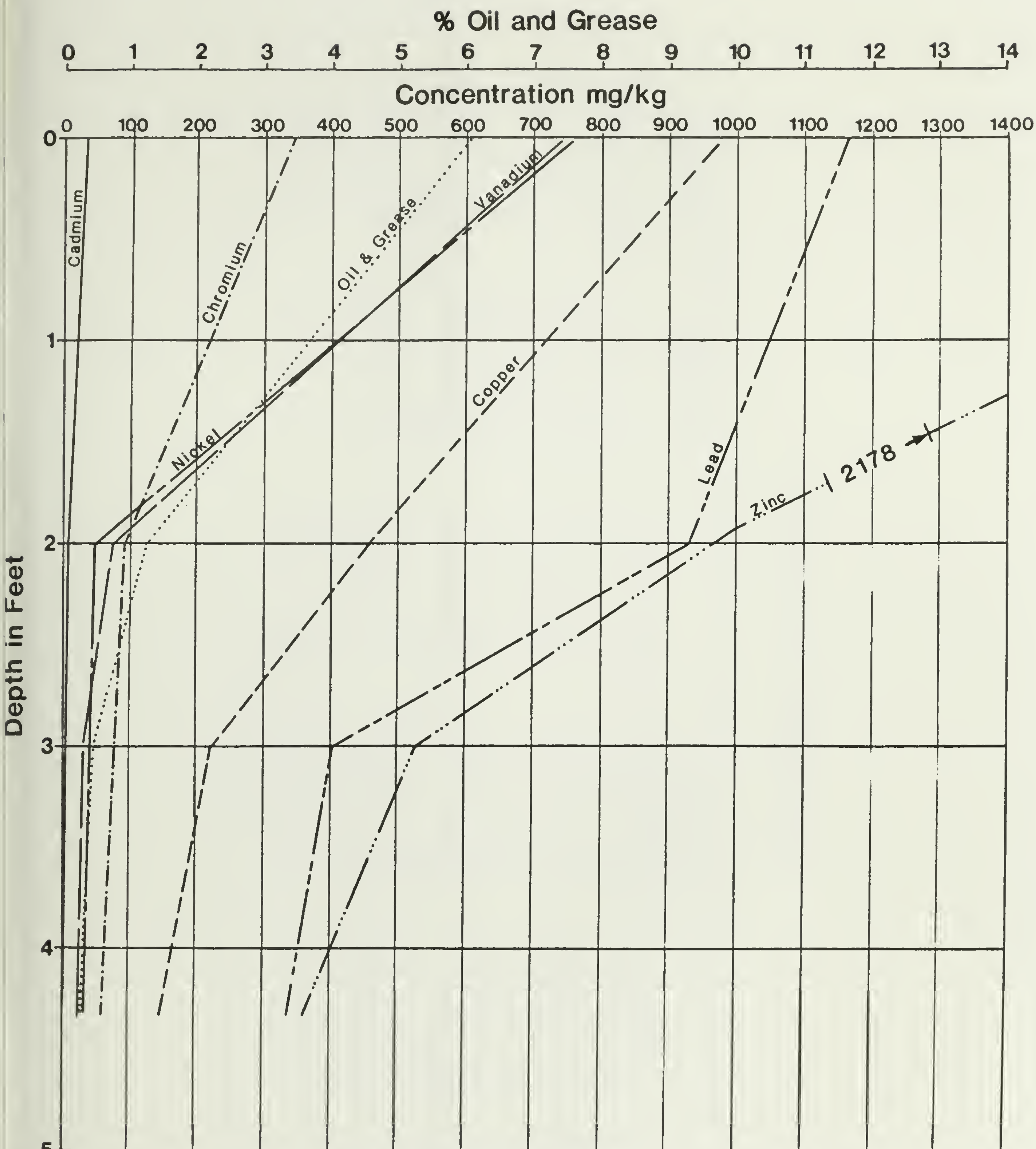


Figure 23
Vertical Distribution of Metals in Fort Point Channel Sediments at Station FP-2

EIS/EIR for I-90, The Third Harbor Tunnel

TABLE 15

AVERAGE SEDIMENT CHARACTERISTICS

PARAMETER		FORT POINT CHANNEL									RAILROAD ALIGNMENT			AIRPORT ALIGNMENT		
		SOUTH BAY			DORCHESTER AVE TO SUMMER ST			SUMMER ST TO NORTHERN AVE								
		SURFACE	MUD	SILT/CLAY	SURFACE	MUD	SILT/CLAY	SURFACE	MUD	SILT/CLAY	SURFACE	MUD	SILT/CLAY	SURFACE	MUD	SILT/CLAY
ARSENIC	mg/kg	107.65	32.20	39.80	125.00	85.37	74.70	44.45	5.80	3.30	32.08	47.80	16.70	47.62	14.76	12.23
CADMIUM	mg/kg	12.70	6.25	3.00	23.75	6.77	2.35	7.75	2.25	1.80	5.62	3.74	0.98	5.28	3.68	1.13
CHROMIUM	mg/kg	107.25	26.65	12.00	292.45	79.80	56.00	176.03	20.35	2.70	303.12	172.02	77.30	319.29	156.50	68.57
COPPER	mg/kg	302.10	158.43	12.00	762.05	361.83	167.40	238.75	135.30	106.90	221.72	133.24	48.78	279.17	118.70	46.34
LEAD	mg/kg	1026.40	423.70	37.30	1041.30	687.77	353.00	431.40	147.25	22.10	262.97	164.28	32.20	224.66	155.07	23.13
MERCURY	mg/kg	20.30	0.68	0.07	3.94	2.10	3.36	3.41	3.13	5.11	2.55	1.99	0.68	2.18	2.03	0.96
NICKEL	mg/kg	80.80	33.50	16.30	1139.95	48.70	32.25	55.80	37.60	36.20	88.64	47.20	33.62	126.89	39.02	37.61
VANADIUM	mg/kg	157.40	32.50	16.90	505.35	56.67	34.35	197.00	4.20	0.40	117.31	96.08	92.23	148.33	93.36	84.69
ZINC	mg/kg	1707.00	453.00	102.40	1306.80	802.47	505.80	495.55	417.80	223.80	440.09	223.84	170.35	406.75	243.63	192.73
PCB	mg/kg	<.005			<.005			0.01			<.005			<.005		
PEST.	mg/kg	<.005			<.005			<.005			<.005			<.005		
P/TOTAL	mg/kg	57.00	17.05	2.80	101.50	44.43	55.20	44.20	53.50	67.60	64.27	50.79	27.53	39.95	32.97	27.52
N/AMONIA	mg/kg	115.20	163.15	87.00	58.85	143.60	117.35	11.70	451.80	974.40	68.22	37.22	25.51	94.58	53.71	15.28
TKN	mg/kg	1562.50	834.15	661.30	532.35	1023.57	1051.15	278.90	2014.00	1601.20	2303.44	582.48	82.96	1700.18	1263.29	80.46
SOLIDS/T	%	27.90	69.40	77.50	23.65	53.37	53.35	40.60	52.25	33.50	43.36	58.48	74.40	33.25	58.97	77.66
SOLIDS/V	%	21.40	27.65	33.60	25.35	11.83	7.15	10.10	9.50	3.20	8.91	4.73	1.75	8.83	4.82	2.32
O&G	%	5.11	1.00	0.17	5.05	0.83	0.27	1.11	1.04	0.46	0.53	0.34	0.06	0.64	0.45	0.19
SILT/CLAY	%	93.00	99.00	93.00	99.00	99.08	93.00	93.00	99.00	93.00	95.93	93.00	93.00	95.93	99.00	99.00
WATER CNT	%	76.20	30.60	22.50	70.35	46.50	46.65	59.40	47.75	66.50	56.75	41.53	25.60	59.26	41.03	22.34
BASE/NEUT	mg/kg	<1	<1		<1	<1		<1	<1		<1	<1		<1	<1	

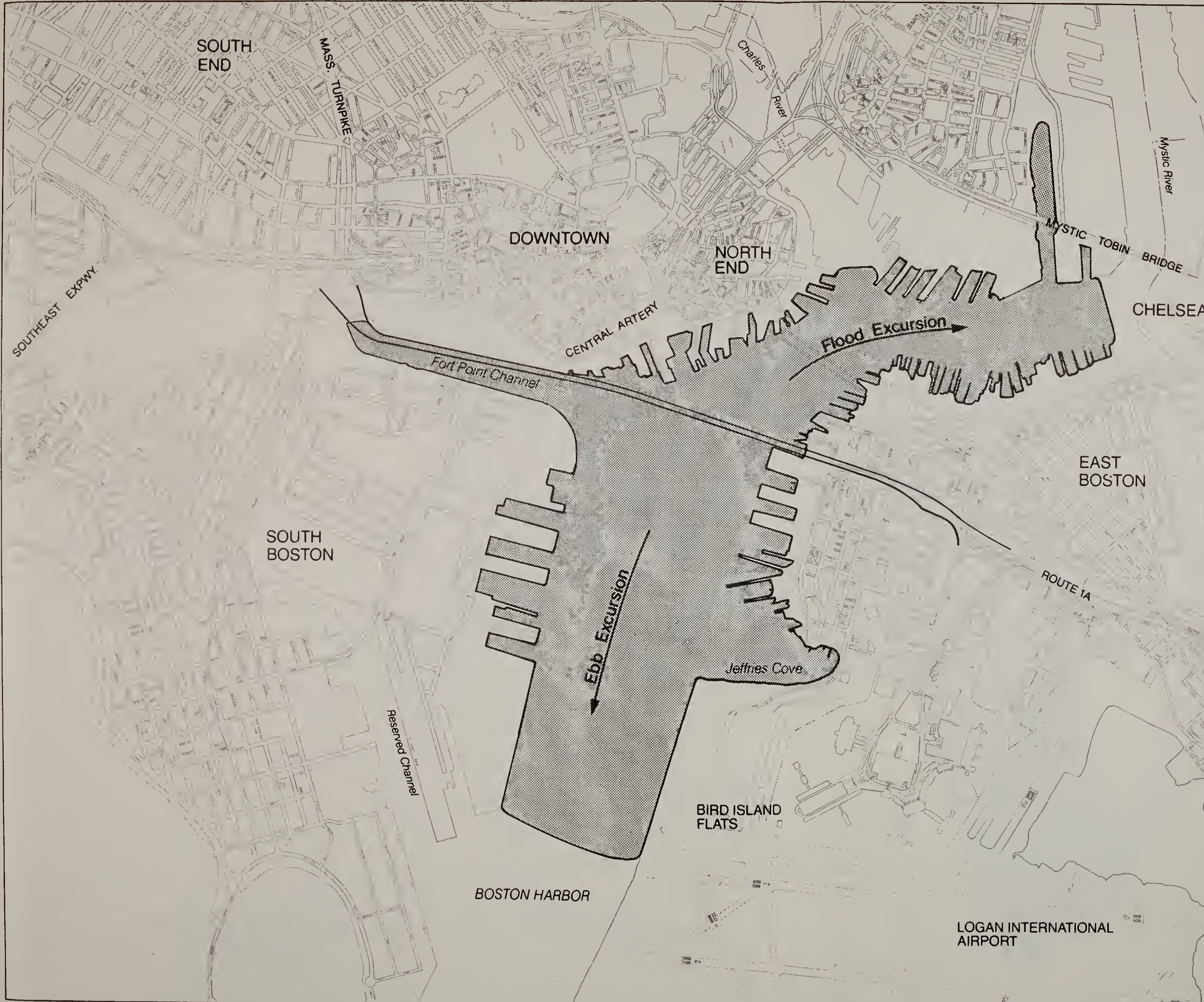


Figure 24
Flood/Ebb Excursion — Railroad Alignment

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

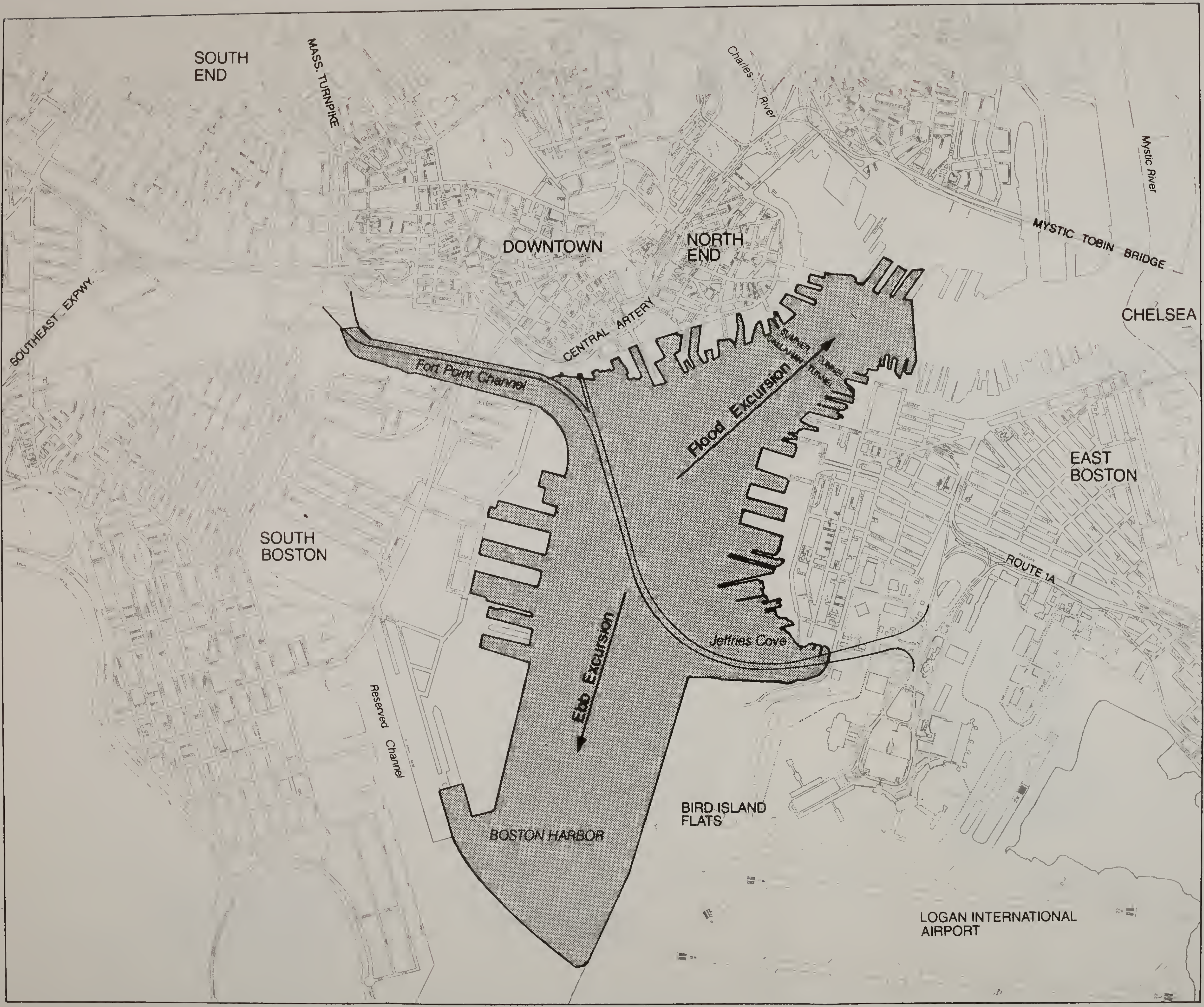


Figure 25
Flood/Ebb Excursion
Airport Alignment

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

discharges of combined sewer overflows are most prevalent.

Sediments

The physical and chemical characteristics of bottom sediment within the project area were determined through an evaluation of existing data as well as site-specific investigations. The Harbor bottom is covered with a layer of organic mud which varies in depth from almost totally absent in the main shipping channel at boring location NH-201 to 4.5 feet in depth east of the mouth of the Fort Point Channel at boring SH-204 (see Figure 22). Portions of the main shipping channel, especially off Pier 1 in East Boston, are virtually devoid of organic sediment. The lack of organic sediment at this location may result from ship traffic passing through a bend in the channel and tide currents. The quality of organic sediment is variable. Lower concentrations of contaminants are found in the shipping channel. However, most organic sediments were found to be contaminated, of Category 3 quality.

Clean sediments were found in the deeper muds and in the Harbor clay layer. Relatively uncontaminated conditions, in general, were found at depths of 2-3 feet below the Harbor bottom.

Surface organic sediment in Jeffries Cove was approximately 3.5 feet in depth, overlying clay, and of Category 3 quality. Cleaner sediment conditions were found deeper in the organic portion, at a depth of approximately 2.5 feet or more. Completely uncontaminated sediments were found at depths more than 5.0 feet below bottom in Jeffries Cove. Sediment characteristics in the project area are summarized in Table 15 above.

Marine Life

Numerous species of finfish are known to inhabit or frequent the Inner and Outer Harbors. A species list is presented in Appendix 7. Annelid worms are the most common species of organisms inhabiting bottom sediments, with pollution tolerant species being dominant. Shellfish also occur in the Harbor with a small localized population at the head of Jeffries Cove near the CSO outfall. However, no harvestable populations occur within the limits of the project alignments or within the limits of tidal excursion from the corridor. Marine vegetation (macroalgae) in Boston Inner Harbor and Fort Point Channel include *Fucus*, *Ulva*, *Monostroma*, *Cladophora* and *Enteromorpha* located on rocks, shells, and pilings in the area.

Species of marine mammals periodically found in the Harbor include the harbor seal, harbor porpoise, and grampus.

3.6.3 Industrial Water Use

A survey of industrial seawater users in the Fort Point Channel and portions of the Inner Harbor was conducted to determine whether these users would be adversely affected during construction of the proposed Tunnel or have their use of seawater restricted as a result of the presence of the tunnel. Seawater users adjacent to the tunnel alignments are shown in Table 16. Of these, the Gillette Company was the only user identified which would require major mitigation measures. Impacts and mitigation measures for the Gillette cooling water intake and other users are discussed in Section 4.8 and in Appendix 7.

3.7 WETLANDS

3.7.1 Description of Existing Conditions

Federal and Massachusetts government agencies with regulatory authority over wetlands define such areas in different terms. According to the U.S. Army Corps of Engineers (COE), federally-regulated wetlands are defined as:

". . . areas that are inundated

Table 16

SALTWATER USE IN BOSTON HARBOR

Name	Location	Primary Use	Maximum Daily Use (mgd)*
Gillette Company	Gillette Park South Boston	Cooling	39.0
Bethlehem Steel	265 Marginal Way East Boston	Cooling	0.28
Massport	Fish Pier South Boston	Washdown	0.43
James Hook & Co.	15 Northern Ave. South Boston	Lobster Support	5.0
Bay State Lobster	379 Commercial St. Boston	Lobster Support	4.32
Hines and Smart	33 Mill Street East Boston	Lobster Support	3.60
Harbor Lobster	Fish Pier South Boston	Lobster Support	1.44
Paul's Lobster	150 Northern Ave. South Boston	Lobster Support	1.44
Neptune Lobster	88 Sleeper St. South Boston	Lobster Support	1.00
Yankee Lobster	272 Northern Ave. South Boston	Lobster Support	0.86
New England Aquarium	Central Wharf Boston	Marine Aquarium	0.15

*Millions of gallons per day.

or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

On the basis of this definition and field investigations, no federally-regulated wetlands occur in the project area.

The Commonwealth of Massachusetts' Wetlands Protection Act defines wetlands more inclusively. Under the Act, project area wetlands are considered coastal wetlands, and thus include the land under Boston Inner Harbor, including Fort Point Channel, as well as lands up to the limit of spring tides, and areas generally inundated by a 100-year storm event. Although areas landward of the high tide line and seaward of the 100-year flood line consist of developed sites and areas dominated by upland vegetation, these areas are considered wetlands under the Wetlands Protection Act.

Figure 26 (Section 3.8) delineates the 100-year floodplain and, thus, the maximum extent of wetlands in the project area governed by the Massachusetts Wetlands Protection Act.

3.7.2 Evaluation of Project Area Wetlands

As no federally-regulated wetlands occur in the project area, and state-regulated wetlands primarily constitute various types of developed land uses, water resources, floodplains, and upland vegetative communities, evaluations of these resources are more appropriately addressed in Sections 3.2, 3.6, 3.8, and 3.9 of this report.

3.8 FLOODPLAINS

Each of the build alternatives proposes conversion of some open water areas in Fort Point Channel to near-surface-tunnel or depressed-open-roadway cross sections. The following provides an inventory of the existing information on flooding and floodplains in the area.

3.8.1 Flooding

The major source of flooding in Boston Harbor results from a combination of high tides (based on astronomic conditions) and water level surges associated with major coastal storms. Such storm surges can be associated with either summer hurricanes or major winter storms with onshore winds.

Recent flooding analyses of Boston Harbor (FEMA, 1982) have assessed both types of events and the resulting flood elevations in the Harbor and surrounding areas. These studies indicated that within the project area, the 100-year storm elevation is 10.0 feet above mean sea level (National Geodetic Vertical Datum of 1929).

Fort Point Channel functions as a component of Boston Inner Harbor and is subject to the same type and magnitude of storm surge flooding as the remainder of the Harbor. Under existing conditions, the influence of freshwater flow on flood levels in the Fort Point Channel is negligible. Freshwater flow would cause an increase in the 100-year storm elevation by only 0.001 feet. Reduction of the cross-sectional area of the Channel by tunnel construction could alter the capacity to carry flow. This aspect is discussed in Section 4.10.

3.8.2 Floodplains

The determination of flood elevation in Boston Harbor constitutes the primary basis for the development of the Flood Insurance Rate Map (FEMA, 1982). This map depicts the upland boundary of the 100-year flood and thus, the floodplain throughout the Harbor. The relevant portions of those maps are shown on Figure 26. The pertinent areas include: Fort Point Channel; Pier 1 in East Boston

and the Conrail right-of-way; and Jeffries Cove, adjacent to Logan Airport. The project is not located in a regulated floodway.

Along Fort Point Channel, the 100-year floodplain is, for the most part, confined by the manmade bulkheads. There are, however, small areas where this is not the case. The largest of these is the area of Necco Street, south of the Channel, which will be inundated during a 100-year flood.

At Pier 1 in East Boston, the entirety of the Conrail right-of-way is included in the floodplain as far north as the Chelsea Creek, as well as low-lying areas along Marginal Street and Clyde Street.

In Jeffries Cove, the 100-year floodplain is confined by bulkheads except for a small area between the end of Marginal Street and the bulkhead along Jeffries Street.

3.9 VEGETATION AND WILDLIFE

3.9.1 Vegetation

Due to the urbanized character of the project area, upland vegetative communities are limited, and consist of successional lands and open space. These sites occur in scattered locations and exhibit a relatively low diversity of plant species. The dominant plants in these areas are herbaceous, including such species as ragweed, milkweed, clover, dandelion, seaside goldenrod, and a variety of grasses. Some woody plant species are also present. Such species typically include tree-of-heaven, black cherry, and staghorn sumac, among others. Characteristic plant species at these sites include sycamore, Norway maple, scarlet oak, lombardy poplar, gingko, clover, dandelion, plantain, and ragweed. A more detailed list of plant species recorded for the project area is presented in Appendix 7.

3.9.2 Wildlife

The wildlife habitat potential of plant communities in the project area is quite limited. This limitation is a function of the scattered locations of the vegetative communities, as well as their relatively small size and proximity to highly developed areas.

Wildlife species observed during field investigations included herring gulls, pigeons, common grackles, starlings, blue jays, American robins, and house sparrows. Additional species, however, are also likely to occur in the project area. A more detailed list of wildlife species observed and expected to occur in the project area is presented in Appendix 7.

3.9.3 Endangered and Threatened Species

Table 17 provides a list of federally-listed endangered and threatened species for Massachusetts. Under state regulations, only the federally-listed species and the small whorled pogonia (a flowering plant) are protected as threatened or endangered species. According to the Massachusetts Division of Fisheries and Wildlife, the whitlow-wort (a flowering plant) is also being considered for listing in Massachusetts.

The U.S. Fish and Wildlife Service and the National Marine Fisheries Service report the occurrence of any of these species in the project area, including Boston Inner Harbor, is highly unlikely.

Although not officially protected by special status designation, a variety of vegetative and wildlife species have been identified as uncommon in Massachusetts. None of these species, however, was recorded during field investigations. Additionally, based on their habitat requirements, none of these species is likely to occur in the project area.

3.10 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Figure 26
100 Year Flood Zone

EIS/EIR for I-90, The Third Harbor Tunnel

Table 17

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Connecticut River and Atlantic Coastal waters
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in Southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in Southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
BIRDS:			
Curlew, Eskimo**	Namenius borealis	E	Alaska to Argentina, Southwest Pacific Ocean: New Caledonia
Eagle, Bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state-Migratory - no nesting
MAMMALS:			
Bat, Indiana**	Myotis sodalis	E	Eastern & midwestern USA
Cougar, eastern	Felis concolor cougar	E	Entire state - may be extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp.(all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
None			
PLANTS:			
Pogonia, small whorled	Isotria medeoloides	Proposed	East and Mid-Western USA
Whitlow-wort (Silverling)	Paronychia argyrocoma albimontana	Proposed	Maine, Massachusetts, New Hampshire

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

** These species are not specifically listed as present in Massachusetts by the U.S. Fish and Wildlife Service. Their inclusion in this list is based on the Massachusetts Division of Fisheries and Wildlife, 1979 Massachusetts Species for Special Consideration. Fauna of Massachusetts, Series No. 5

Source: U.S. Fish and Wildlife Service, 1980 and 1982.

3.10.1 Historical Resources

This section identifies the historic sites within the project area which are either listed, eligible or potentially eligible for listing on the National Register of Historic Places. These sites have been identified through an intensive field inventory and a literature review undertaken as part of this study. The findings of this effort are documented in a separate report "Historical Resources Inventory", and have been discussed with the Massachusetts Historical Commission and the Boston Landmarks Commission. Consultations with these agencies was a basis for judging the potential eligibility of resources in the project area.

East Boston

East Boston's historical resources include single and multi-family dwellings, industrial and marine structures, commercial blocks, schools, churches and squares. Although the industrial and marine structures are largely gone, most other physical evidence of East Boston's history and development remains. The community's pattern of streets and squares -- a rectilinear grid laid out in 1833 -- is itself an artifact of East Boston's past. Much of the architecture has undergone alteration, but the general character and patterns of use remain clearly visible. Several potential National Register districts exist, along with a number of individually noteworthy structures.

The numbered historical resources below are located on Figure 27.

1. Woodbury Building (1841). 191-201 Sumner Street and 3-13 Lewis Street.

Three-story brick commercial block of granite shop fronts; it is probably the earliest commercial building in East Boston.

2. Streetcar Tunnel (1904, electrified 1924). MBTA Blue Line tunnel from Boston to Maverick Square.

The second oldest underwater vehicular tunnel in North America.

3. 8-16 Henry Street and 9-11 Paris Street (ca. 1840).

Greek Revival, red brick residential block from East Boston's earliest development.

4. 184-194 Sumner Street (ca. 1840).

Greek Revival commercial buildings; red brick with granite shop fronts.

5. 12-24 Paris Street (ca. 1840).

Greek Revival row houses, red brick with granite and brownstone trim.

6. Our Savior American Lutheran Church (early 20th century). 28 Paris Street.

Georgian Revival brick church from the immigration period.

7. Jeffries Point District (nineteenth century) - a potential National Register district.

This is perhaps the best illustration of the residential (and social) development of East Boston in the last three-quarters of the nineteenth century. Dwellings range from small frame workers' cottages to Greek Revival brick bow-fronts, to Italianate and Queen Anne triple-deckers. Many have been altered, but the architectural fabric is essentially intact.

The district also includes the Golden Stairs, originally built to provide access from Belmont Square to the shore; Our Lady of the Assumption Church, Rectory and School, a Late Victorian church complex dating from the heyday of Belmont Square; and the Samuel Adams School.

Historic Property
Historic District

Figure 27
Historical Resources in East Boston

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

8. Sumner Street Fire Station (late nineteenth century). 260-262 Sumner Street, corner of Orleans Street.

A handsome late 19th century fire station, brick with stone trim, now owned by Boston Public Works Department.

9. Immigrants' Home (1912). Marginal Street.

Built and operated as a refuge for immigrants landing in North America.

10. Butler Aviation Hangar (1930's). Logan Airport.

The original Eastern Airlines Hangar; one of the earliest buildings at the airport.

Boston Waterfront and Fort Point Channel Area

The following historical resources are located on Figure 28.

11. Fort Point Channel District (1880 - 1930's) - potential National Register District.

The Fort Point Channel area, including the Channel itself, the bridges over it, and the wharves, warehouses and transportation facilities on either side of it, comprise a physical record of the complex transportation developments which necessarily accompanied the rapid industrial expansion of Boston in the late nineteenth and early twentieth centuries, and is a symbolic vestige of the original Shawmut Peninsula. It is potentially eligible for the National Register.

The district includes the following contributing elements.

a. The Fort Point Channel (ca. 1890's).

Historic waterway bordered by granite bulkheads, created as part of late nineteenth century industrial/transportation development of South Boston.

b. The Northern Avenue Bridge (1908).

Pivotal lift swing bridge; it has been determined eligible for National Register.

c. Congress Street Bridge (1930).

Single-leaf bascule bridge; it represents the final period of development of the Channel and warehouse subdistrict.

d. Summer Street Bridge (1898).

A retractible bridge, a design developed in Boston; although inoperable it is one of only two remaining such bridges in the city.

e. Old Colony Railroad Bridge (1899).

A Scherzer rolling lift bridge, perhaps the most important of South Boston's many bridges.

f. Boston Wharf Co. Warehouse District (1880 - 1930).

A unified district of late nineteenth and early twentieth century industrial buildings built by the Boston Wharf Co.

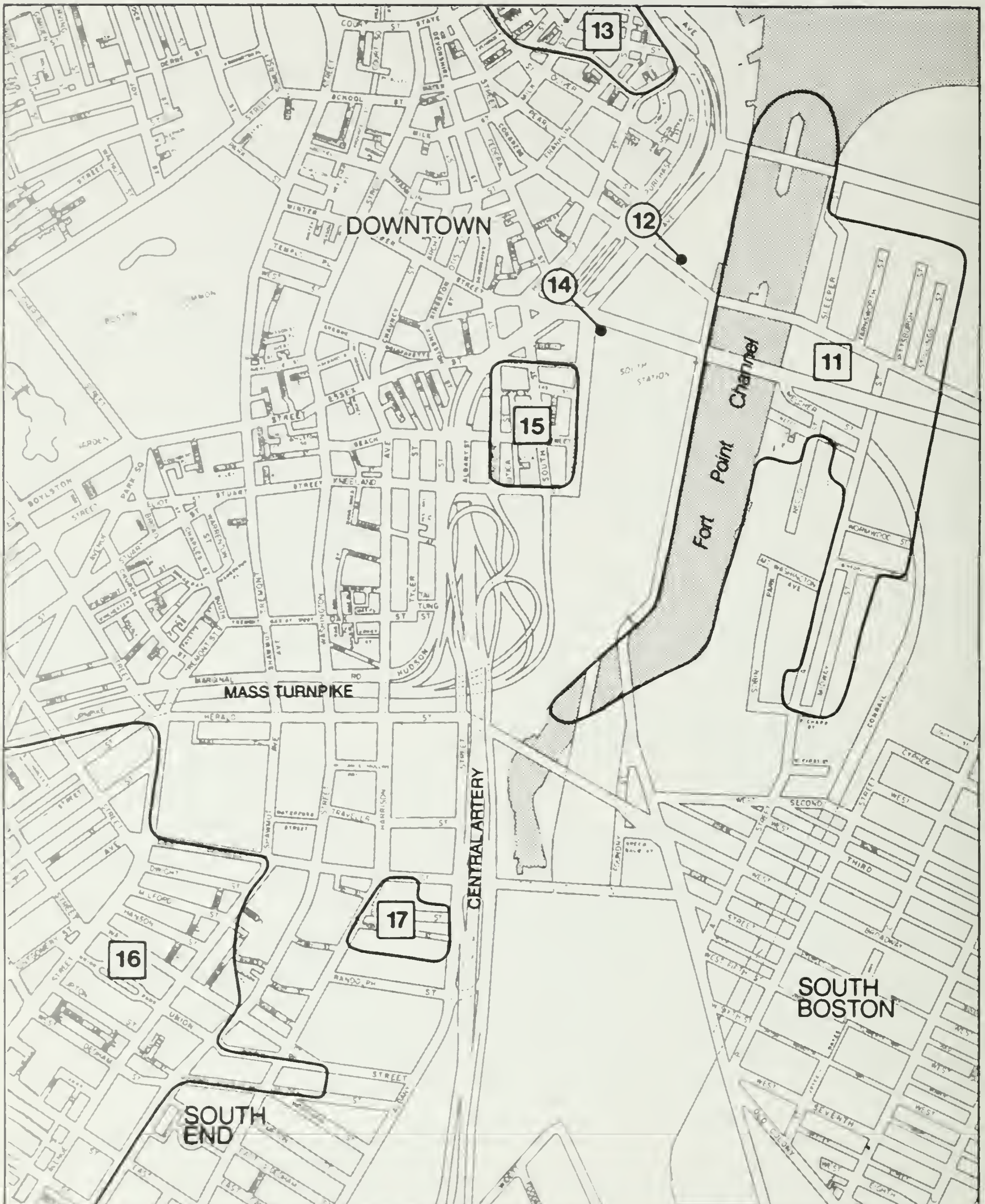
g. Factory Buildings Trust/A Street Industrial Buildings

Extension of the Boston Wharf Company industrial development; industrial buildings dating from 1890's - 1930's.

12. Russia Wharf Buildings (1897 - 1898). 518-540 Atlantic Avenue; 270, 276-290 Congress Street.

Classical Revival style commercial/industrial buildings listed on the National Register.

13. Custom House National Register District



Historic Property
Historic District

Figure 28
Historic Resources in the Boston Waterfront, Fort Point Channel, South End South, Cove Areas

0 250 500 1000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

The Custom House District encompasses one of the most historic portions of Boston's Financial District. It includes part of State Street, the original main street of commercial Boston, dating from the seventeenth century, which led from Long Wharf to the Town House. The District is centered on Broad Street, created by landfill in the Federal Period and financed by an association of many of the leading merchants of the day. The Broad Street area was laid out by architect Charles Bulfinch, and nine of the original buildings he designed are still in the District. In addition to these, the district contains many outstanding commercial buildings from succeeding periods, including a number by leading architects of their day. Privately owned except for city streets.

14. South Station Headhouse (1898). Corner of Summer Street and Atlantic Avenue.

Boston's only remaining "grand union terminal"; listed on the National Register.

15. Leather District (1890's).

Homogeneous area of late nineteenth century commercial buildings related to Boston's important leather business; determined to be eligible for the National Register.

South End/South Cove Area

Little above-ground physical evidence of early development remains in the area which may be affected by the project. Further to the west is the South End National Register District and a proposed Boston Landmark District. At the edge of these districts one small group of nineteenth century warehouses remains. The following historical resources in the area have been identified and are also presented on Figure 28.

16. The South End National Register District (nineteenth century).

A district of Victorian bow-front row houses; it is the largest residential National Register district in the U.S.

17. Albany Street Area (1880's and 1890's) - a potential National Register district.

An area of several long, five-story brick and granite warehouses representing the industrial development of the Albany Street warehousing area in the last decades of the nineteenth century.

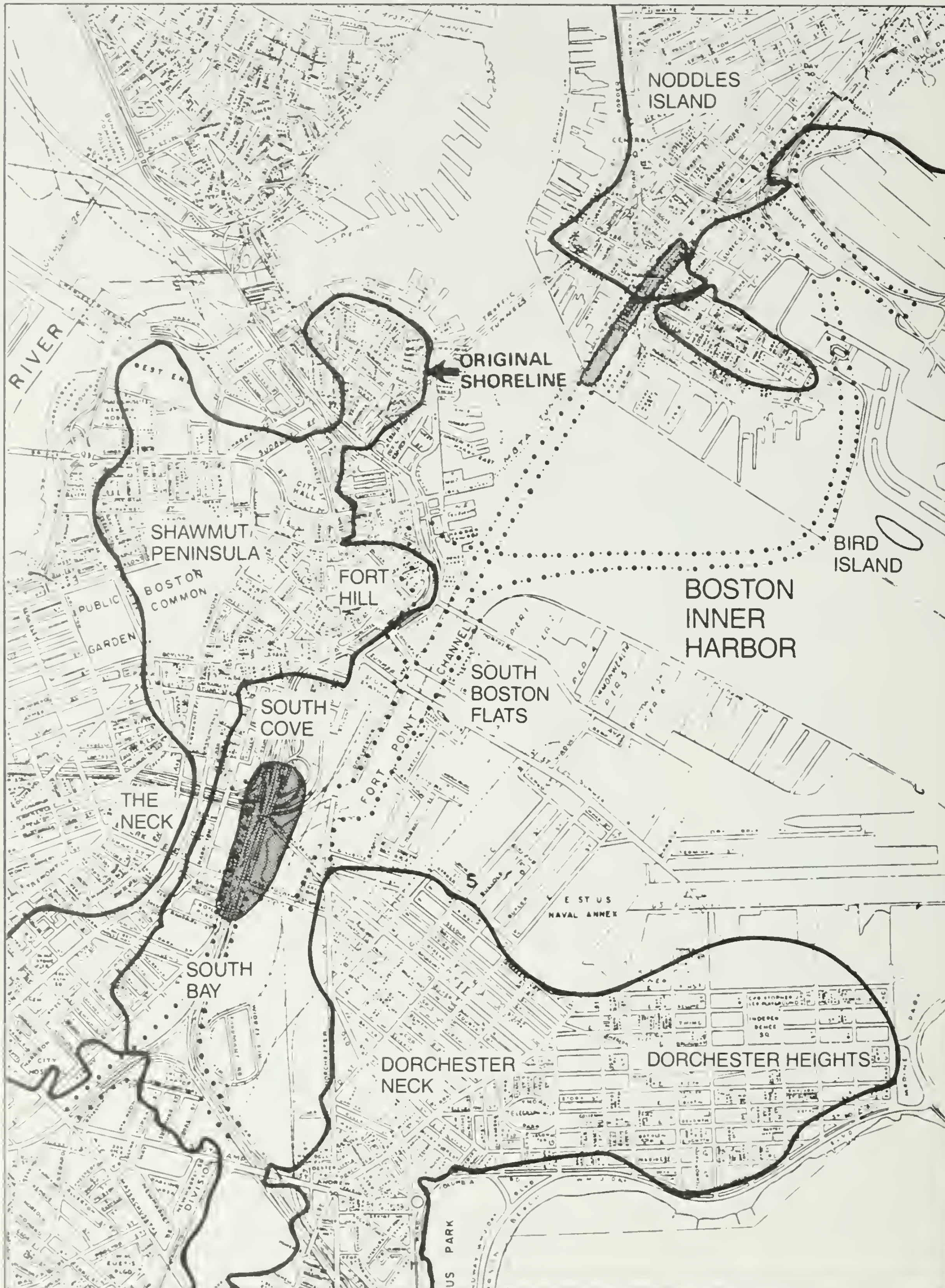
3.10.2 Archaeological Resources

The "Archaeological Survey of the Third Harbor Tunnel Crossing, Boston, Massachusetts, Final Report," prepared by the Harvard University's Peabody Museum, Institute for Conservation Archaeology presents the results of a reconnaissance level survey of the project area, including sections of the South Bay, South Cove, Fort Point Channel, and Fort Hill areas of Boston to the south of the Harbor, and East Boston including the airport to the north of the Harbor. The information presented in that report indicated there is a high probability of significant historic archaeological resources being located in all of these areas, and significant prehistoric archaeological resources being located in only selected areas. Figure 29 presents the limits of the original shoreline in this area, and the areas with significant probability of locating archaeological sites.

3.11 UTILITIES

The project area includes a maze of underground, publicly and privately-owned utilities. Types of utilities encountered include storm drains, sanitary sewers, combined sewers, water mains, gas mains, telephone and power lines, fuel lines, steam lines, fire alarm and police communication systems, etc.

Major utilities which are located within the project area are indicated on Figure 30 and are keyed to the list below.



Archaeologically Sensitive Areas
Original Shoreline

Figure 29
Original Seventeenth Century Shoreline

0 2200 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Figure 30
Major Existing Utilities

EIS/EIR for I-90, The Third Harbor Tunnel

1. East Side Interceptor, 32-inch x 54-inch combined sewer (CS) located in Atlantic Avenue.

2. 72-inch CS from Purchase Street to Oliver Street, crossing the Central Artery and Atlantic Avenue to Fort Point Channel near Hook's Lobster.

3. Fort Point Channel outfalls in Dorchester Avenue: at Congress Street, 36-inch x 36-inch CS; at Summer Street, 60-inch CS; from Kneeland Street, 81-inch x 81-inch CS.

4. 60-inch CS outfall to Fort Point Channel at Dorchester Avenue Bridge.

5. Massachusetts Turnpike Authority (MTA) pump house #7.

6. South Bay outfalls: 72-inch CS at Albany Street near Traveler Street, 36-inch and 8-inch force mains from MTA pump house #7, 48-inch CS near West Fourth Street, two 10-inch discharge pipes from MBTA pump house at Tidal Drain Reservoir.

7. East Side Interceptor in the vicinity of the railroad yards and crossing under the Turnpike ramps, 32-inch x 54-inch CS.

8. Railroad Tidal Drain Reservoir in railroad yard adjacent to Broadway.

9. MBTA pump house at Tidal Drain Reservoir.

10. Roxbury Canal Conduit outfall, twin 20-foot x 15.5-foot pipes.

11. Boston Edison utility tunnel crossing Fort Point Channel between Congress Street and Summer Street.

12. 115,000 volt electric lines at Purchase Street and Oliver Street crossing Central Artery to Boston Edison sub-station near Harbor Plaza Building.

13. 115,000 volt electric lines from Boston Edison sub-station, crossing Fort Point Channel to South Boston near Northern Avenue.

14. 115,000 volt lines from Harrison Avenue suspended on Broadway Bridge crossing to South Boston at Dorchester Avenue.

15. 30-inch Intermediate Pressure gas pipe crossing area of Turnpike ramps and railroad yard from Kneeland Street to Albany Street.

16. 24-inch Intermediate Pressure gas pipe crossing West Fourth Street from Albany Street to the Gillette Company.

17. Telephone submarine cable between Congress Street and Summer Street crossing Fort Point Channel from Dorchester Avenue and Sleeper Street in South Boston.

18. 16-inch and 24-inch water mains crossing Fort Point Channel from Dorchester Avenue at Congress Street to Northern Avenue in South Boston.

19. 60-inch storm drain adjacent to Bird Island Flats (BIF) access road.

20. Telephone and electric duct banks servicing several airport locations.

21. 8-inch sanitary sewer force main in BIF access road.

22. 20-inch water line in BIF access road.

23. 12-foot x 10-foot Porter Street combined sewer outfall.

24. 20-inch water line in vicinity of East Boston Athletic Field.

25. 7-foot 10-inch x 8-foot 2-inch storm drain in vicinity of East

Boston Athletic Field.

26. 24-inch sanitary sewer in vicinity of MBTA Airport Station.

27. 6-foot 6-inch x 4-foot 4-inch railroad drain in vicinity of MBTA Airport Station.

28. 60-inch storm drain in vicinity of Emery Air Freight Building.

29. 6-foot x 6-foot 4-inch combined sewer in Porter Street in vicinity of railroad crossing and Orleans Street.

30. 24-inch water line crossing Airport access and egress roadways, near MBTA Airport Station.

31. 12-inch gas line crossing Airport access and egress roadways near MBTA Airport Station.

32. 36-inch storm drain crossing East Boston Expressway and Airport egress roadways.

33. Railroad drainage storage box near MBTA Station.

In addition to these existing utilities, a number of new utilities have been proposed by others within the project area. These utilities are proposed for construction, subject to funding constraints, regardless of the Third Harbor Tunnel alternatives. The following summarizes the proposed utility construction by others.

o Fort Point Channel Combined Sewer Overflow (CSO) Primary Treatment Facility located at the downstream end of the Roxbury Canal Conduit in South Bay, between West Fourth Street and Broadway Bridge.

o Wet weather conduit to convey flows (including storm overflows) from the Boston waterfront CSO consolidation pipeline to CSO treatment facility in South Bay.

o Consolidation pipeline to collect combined sewer overflows from South Boston to treatment facility in South Bay.

o East Boston-Southern Waterfront Combined Sewer Overflow Primary Treatment Facility located at Bird Island Flats.

o Consolidation pipeline along the south waterfront of East Boston to CSO treatment facility at Bird Island Flats.

o New Boston Main Interceptor and East Side Interceptor Sewers (north branch and south branch) from Massachusetts Avenue to High Street.

o 20-inch force main crossing Albany Street at Broadway and running parallel to the north side of Broadway Bridge to outfall in South Bay.

More specific information regarding the locations of these major utilities is contained in the Supportive Engineering Report.

3.12 VISUAL CHARACTERISTICS

Fort Point Channel/Boston Area

To describe visual characteristics, the Boston side of the project area can be divided into two segments. The first, or south, segment comprises the Central Artery corridor from the Massachusetts Avenue interchange to the interchange with the Massachusetts Turnpike; the second or north segment comprises the eastern edge of downtown Boston, including the Dewey Square Tunnel, the South Station area above it, the Fort Point Channel, the Central Artery, and the Waterfront.

The sections of highway on the Boston side of the Harbor form a significant and memorable entryway to the City, and the visual image experienced here influences motorists' image of Boston as a whole. At the same time, the highways are linear barriers, creating a hard edge to adjacent districts of the City, except where the highway passes through the Dewey Square Tunnel; here, downtown is

perceived as extending to South Station and the Fort Point Channel.

South Segment

The area surrounding the Central Artery in the south segment is automobile and railroad-oriented or industrial in character. Neighborhoods lie beyond the highway zone and are remotely visible from the roadway. Immediately next to the highway, buildings are generally low, and are surrounded by large expanses of land used for parking, loading, and rail yards. The visual environment is very open, exposed, and flat. Several industrial landmarks are located in the area: the Italianate tower of the Pine Street Inn in the South End, the triple smokestacks of the abandoned Boston incinerator, and the railroad bridge and open water of the remaining South Bay; however, it is unlikely that any of these landmarks have much significance to most motorists apart from their strong visual forms.

North Segment

The area above the Central Artery and the Dewey Square tunnel is one of complicated circulation patterns and pedestrian vehicle conflicts which demand the attention of both motorists and pedestrians; nonetheless, several major landmarks are sufficiently dominant to be easily noticed: South Station, Federal Reserve Bank, and the hexagonal Fiduciary Trust Building. Glimpses of the retail district and the Fort Point Channel can be seen in opposite directions along Summer Street, and the towers of the Financial District are visible beyond Dewey Square.

Upon emerging from the existing tunnel north of Dewey Square, the motorist receives dramatic views of Harbor Towers and the Waterfront. Pedestrians are confined to narrow corridors between the elevated Central Artery and the rows of buildings fronting on Atlantic Avenue and Purchase Street; confined views to the Channel are presented along cross streets and vacant parcels.

The Fort Point Channel is visible to motorists or pedestrians crossing one of the three bridges in this area, but the most significant views are presented to direct abuttors and to the many tourist and lunchtime visitors for whom the views of the Channel and Harbor are a major reason for being there.

The Channel's major visual aspects are its large water surface, its views to the Harbor and East Boston, and its maritime and historic character represented by its bridges, anchored or berthed ships, and by the five- to nine-story masonry buildings which line much of its shoreline from Summer Street north. The Federal Reserve Bank, Stone and Webster Building, and Postal Annex contrast in material and scale with the other buildings along the Channel. Pedestrians walking along Museum Wharf, the Congress Street Bridge, (and at rush hours, Northern Avenue Bridge) are both the observers of the visual environment and part of the environment, adding human scale activity and interest to the area.

East Boston Railroad Right-of-Way

In East Boston, the railroad right-of-way forms a physical and visual dividing line between the Jeffries Point and Maverick Square neighborhoods. The character and ambience of the two neighborhoods are quite distinct, and their relationships to the right-of-way are different. Except to abutters, the railroad land is not visible from within the Jeffries Point or Maverick/Central neighborhoods.

Bremen Street forms the western boundary to the right-of-way cut, and the buildings along Bremen Street face into it. The west side of Bremen Street is almost continuously developed with three-story frame row houses. The Heritage Apartments, located on South Bremen Street, are brick three- and four-story structures. The residential building finishes are a variety of colors and the detailing, vacant lots and space between houses

makes a varied wall of structures. South of Maverick Street, Bremen Streetis quiet and set apart from the bustle and traffic of East Boston.

From the western side, the right-of-way is viewed directly from the street and residential front windows. Along Bremen Street, between Sumner and Gove Streets, a granite wall about four feet high forms an edge to the right-of-way, and provides a visual screen for pedestrians walking along the street. In several locations, a line of trees also forms an edge to the street.

The right-of-way is not visible except to abutters from Orleans Street because buildings and a bridge lie between it and the street. The Orleans Street edge of the rail cut is bordered by a variety of buildings and open lots. Most of the buildings face Orleans Street although several face Maverick or Sumner Street. These buildings including the Victory Gardens Elderly Housing development, have their backs to the right-of-way but most have views of it from kitchen or bedroom windows.

The rail cut is viewed by the greatest number of people from the three bridges over the right-of-way and from the Gove Street pedestrian path. As the viewer emerges from the densely built up neighborhoods on either side onto the bridges, the right-of-way appears as an open area.

The aesthetic quality of the right-of-way changes with the season. In summer it is overgrown with tall grasses, wild flowers and cattails. Many small ailanthus trees flourish. When the dense summer vegetation dies, the accumulation of trash becomes evident and the area appears more abandoned than wild. Between Gove and Porter Streets the right-of-way is occupied by several car rental, parking, and freight forwarding firms. The appearance of this area is that of an open parking lot with shed buildings along both edges.

The East Boston urban landscape is made up of buildings which are quite similar in scale and detailing. The few modern structures echo the older buildings in detailing and materials. There are three large structures in the project area: two older industrial buildings on Orleans Street south of Porter Street, and the Massport Pier 1 building at the Harbor's edge. The view of Boston from the bridges over the right-of-way, Bremen Street and from the right-of-way itself is dramatic.

Logan Airport

The airport alignments (Alternatives 3 and 5) cross Jeffries Cove and the service area of the airport. The Cove is bordered on the east by the shoreline of Bird Island Flats, currently being developed by Massport as a major mixed-use development with a wall of commercial buildings forming a visual and noise buffer along the edge of the airport, and a passive linear recreation park along the Cove. Along the west side of the Cove is Porzio Park, a neighborhood playground; several wooden piers; a variety of small- to medium-scale residential and industrial buildings; the massive structures of the Bethlehem Steel shipyard; and the row houses of the Jeffries Point neighborhood on rising ground beyond. The water surface of the Cove, anchored boats, and outstanding views of Boston and South Boston are major visual amenities. The Cove is rather narrow at its head, and views change significantly with changes in vantage point. Pedestrian activity is expected to increase following completion of the Bird Island Flats project.

The airport is a large expanse of large scale structures, parking areas, and roadways. Most structures are one to two stories in height; exceptions are the Eastern Airlines hangar, Hilton Hotel, parking garage and control tower. Pedestrian activity is almost absent outside the termimal buildings, and views from the road are dominant.

4.1 DESCRIPTION OF CONSTRUCTION

This section describes construction methods and construction sequencing for the build alternatives. It also describes assumptions regarding the maintenance of existing utilities and traffic during construction. The effects of construction, based on these methods and assumptions, are discussed in the appropriate sections of this Chapter.

4.1.1 Construction Methods

Each build alternative contains several major elements requiring different construction methods.

Sunken tube construction is proposed for the harbor crossing itself. Prefabricated concrete or steel sections, approximately 500 feet long and approximately 88 to 120 feet wide, would be towed to the site by barge, sunk into a trench previously dredged in the harbor bottom, joined underwater, and covered with backfill. Fabrication of the tunnel sections would be done off-site. Several concrete tube fabrication sites were investigated, including the proposed Lynn Marina Industrial Park area in the Port of Lynn, Massachusetts; the New London Mills area on the Thames River in New London, Connecticut; and the United Steel Buildings area on the Mill River in New Haven, Connecticut. Steel tubes, if used, would be fabricated in one of several shipyards located on the east coast.

Cut and Cover tunnel construction is necessary on land and in the Fort Point Channel, where sunken tube construction is not feasible. Three types of cut-and-cover construction would be used.

In Fort Point Channel, silt will be excavated from the Channel bottom and carried away by barge for ocean disposal (see Section 4.12); piles would be driven to support the tunnel structure, and then steel sheet piles (or "sheeting") would be driven to enclose the construction site. Within the barrier of sheeting, water would be pumped out, the tunnel and ventilation buildings would be constructed, the excavation backfilled, and the sheeting then removed.

At the Airport (Alternatives 3 and 5) and in the proposed railroad right-of-way toll plaza area of East Boston (Alternatives 2 and 4), the construction method would involve sheeting, excavation and dewatering within the sheeted area, construction of the tunnel, backfilling, and restoration of the original ground surface.

South of the toll plaza proposed in Alternatives 2 and 4 (railroad alignments), tunnel sidewalls would be constructed using the slurry wall method. This method has been proposed because it can be accomplished in a narrow construction area, thus minimizing disruption. In this method, tunnel walls are precisely excavated with special machinery and the deep trench excavation is temporarily supported by filling it with a water/clay mixture called bentonite (or "slurry"). Reinforced concrete walls are then poured in place while the slurry is pumped out and removed from the site. The material between walls is then excavated, bottom and top concrete slabs are constructed, and the tunnel is finally backfilled.

4.1.2 Construction Sequencing

Approximately three years will be required for construction of Alternatives 2 or 4 (railroad alignments) and four years for construction of Alternatives 3 and 5 (airport alignments). Assuming construction is commenced in late-1986 and assuming the availability of adequate Federal funding, the overall project would be expected to be completed in approximately late-1989

or 1990.

An extensive evaluation of the construction sequences associated with each of the alternatives is documented in the Supportive Engineering Report. In order to minimize the disruptive effects of construction in any particular area, construction contracts will be prepared which allow completion of specific portions of the project within a single construction season or less. These completed portions of the Project may subsequently be used to carry traffic while other facilities are closed to traffic.

Construction of the tunnel tube sections off-site will require nearly the full three to four year construction period, primarily for the fabrication of the tunnel sections at the drydock area. Actual placement of the tunnel sections in the harbor will require approximately one month per section and one day for sinking. (Alternatives 2 and 4 require approximately 10 tunnel sections, while Alternatives 3 and 5 require approximately 20 tunnel sections.)

Dredging activities in Boston Harbor will probably be performed using the clam shell method, and will be suspended during flounder spawning season. Recreational boating activities as well as commercial navigation requirements in the Harbor have also been assumed in developing the construction sequencing for the various alternatives.

4.1.3 Maintenance of Traffic and Existing Utilities

The build alternatives will require temporary or permanent relocation of some utilities, and construction period detours of traffic and rail services either to temporary structures or parallel routes. The lengths of such detours and the amount of time any detour is in use will be minimized as much as possible.

The assumptions used in planning construction are as follows.

In Boston:

1. Except for the new Northern Avenue Bridge, all of the bridges crossing the Fort Point Channel will be affected by tunnel construction. To minimize traffic impacts, temporary bridges will be used while the Summer Street and Congress Street bridges are being reconstructed. The Broadway Bridge and the West Fourth Street Bridge will each be closed for a period of approximately one year; staging requirements will not permit both bridges to be closed at the same time.

2. In the South Bay area, a temporary railroad bridge ("Wye Connector") will be built to maintain rail service during the construction period when the existing Wye Connector (presently proposed by the MBTA and to be constructed prior to 1987) is shut down.

3. Five tracks into South Station and two tracks across the Dorchester Branch railroad bridge over Fort Point Channel will be provided at all times by use of temporary track beds.

4. The West Fourth Street Bridge will be reconstructed to handle the truck traffic that will be temporarily detoured during the reconstruction of the Broadway Bridge.

5. The Broadway and West Fourth Street Bridges, when reconstructed, will accommodate the MBTA's plan for a Red Line express from Braintree to South Station.

6. Atlantic Avenue (one way) will have one lane open at all times in the area of tunnel construction.

Additional assumptions pertaining to Alternatives 2 and 3 (split alignments) include:

7. The Central Artery will be maintained at its present 40-foot width (3 lanes) in each direction. This would be accomplished by temporary bridge and roadway construction.

8. Before the Central Artery portal is reconstructed near Northern Avenue, the new tunnel and relocated Dorchester Avenue in Fort Point Channel will be available for rerouting of traffic.

9. The Harbor Plaza Building will be underpinned, permitting tenants to remain during construction.

In East Boston:

10. The same number of lanes that exist today on the airport roadways will be maintained at all times; however, the service road crossing between the inbound and outbound airport roadways will be disrupted for six months. Traffic using this crossing will be detoured.

11. Access to East Boston Memorial Stadium will be maintained at all times. Direct access to the proposed Bird Island Flats shoreline park (to be developed prior to 1987) from the Jeffries Point neighborhood will only be disrupted for 2 to 4 months (airport alignment alternatives only); disruption may be avoided altogether if an alternative route is made available on airport property. Access to the park will be possible from the Airport/BIF area during this period.

12. Service on the MBTA's Blue Line will be maintained.

13. Bridges crossing the railroad right-of-way will be reconstructed sequentially, each bridge being reopened to service prior to closing the next. Demolition and reconstruction will take approximately nine months for each bridge. Pedestrian access (and utilities) will be maintained via temporary crossings constructed next to each existing bridge. Detour routes (bridges) will be provided at Marginal and Gove Streets to provide access between Orleans and Bremen Streets.

14. The existing number of lanes on the highway ramps to and from the airport will be maintained, with temporary structures used as necessary.

4.1.4 Materials Movement and Staging Areas

Dredged material will be removed from the construction area by barge and disposed at the foul hazard area at sea (see Section 4.12). Surplus excavated material from the railroad area in East Boston (Alternatives 2 and 4) and the Airport (Alternatives 3 and 5) would be removed by truck on haul roads in the railroad right-of-way leading directly to Route 1A; use of local streets for construction activities will be minimized. Disposal of this material will be the responsibility of the Contractor; site approvals and permits are also the Contractor's responsibility.

In the South Bay area, truck access to the Turnpike and Central Artery would be via the existing Turnpike/Central Artery interchange, using the Broadway and West Fourth Street Bridges, Frontage Road, and Albany Street. Construction vehicles would also use Dorchester Avenue on the Boston side of the Fort Point Channel.

Staging Areas would also be needed during construction. These areas would be used for purposes such as material stockpiling, equipment storage, parking, and contractor field offices. Locations cannot be specified in advance, but their use would be controlled by contract specifications to reduce impacts on adjacent properties. Potential staging areas include but are not limited to portions of the airport, especially the present Butler Aviation site and unbuilt portions on Bird Island Flats; the backland area of the East Boston Piers; and the railroad yards in the northern industrial portion of South Boston and/or in South Bay.

Sunken Tube Drydock and Fabrication Area. Several sites for fabricating the tunnel tube sections were investigated (identified in Section 4.1.1), in addition to evaluations of various aspects of both

concrete and steel tunnel tubes. These aspects included construction costs and techniques, engineering properties of the construction materials, construction feasibility, etc. At this time, it appears that reinforced concrete tunnel tubes are most desirable, as documented in the Supportive Engineering Report. The following discussion relates to the preferred fabrication site for these tunnel sections.

A coastal area of 75 acres suitable for fabrication of concrete tunnel tube sections has been identified in Lynn, Massachusetts, immediately to the east of the General Edwards Bridge crossing of the Saugus River (see Figure 62 in Section 4.17). The area abuts natural gas storage tanks and is heavy industrial in character. It has immediate vehicular access from Route 1A. The proposed fabrication area would require construction of an earthen dike and would be dredged to form a dry dock within which tunnel sections would be built and then floated out. A concrete plant, material storage, parking, and contractor field offices would occupy the upland portion of the site. The potential use of this site for fabrication of the tunnel tubes has been suggested by the City of Lynn Economic and Development Corporation. Water quality and wetland impacts at this site are discussed in Section 4.17 of this report.

4.2 TRANSPORTATION

Transportation impacts of the Third Harbor Tunnel project build alternatives are compared to the No-Build Alternative in this section in the following sequence:

- Traffic Volumes: Daily AM peak hour, and PM peak hour volumes on the affected highway and local roadway network in 1990 and 2010, and comparison to 1982.
- Volume-to-Capacity Ratios and Levels of Service: AM and PM peak hour operating conditions on the affected highway and local roadway network in 1990 and 2010, and comparison to 1982.
- Central Artery Bottlenecks and Congestion Points: AM and PM peak hour queues on the Central Artery in 1990 and 2010, and comparison to 1982.
- Vehicle Miles and Vehicle Hours Travelled: Total roadway network comparisons for 2010.
- Safety: Accident potential on the affected highway and local roadway network in 1990 and 2010, and comparison to 1982; emergency vehicle access; hazardous cargoes.
- Other Transportation Facilities: Logan Airport and public transportation in 1990 and 2010, and comparisons to 1982.
- Construction Impacts: Construction period (1987-1990) traffic implications on the South Bay/Fort Point Channel area; Central Artery/Surface Artery north of Dewey Square; East Boston Railroad Right-of-Way area; Logan Airport area; and public transportation facilities.
- Consequences of Other Transportation Improvements: Central Artery ramp modifications; public transportation (Blue Line, suburban bus, limousine, cross-harbor ferry) improvements; and alternative toll collection practices.

4.2.1 Traffic Volumes

Average Weekday Daily Traffic

Average weekday daily traffic (AWDT) volumes for selected regional and local (South Boston, East Boston and Revere) roadway links are summarized in Table 18 for existing

conditions and for the forecast years of 1990 and 2010 for the five alternatives.

Highway Network

Traffic Growth Without The Project. Section 3.1 detailed anticipated traffic growth without the Third Harbor Tunnel Project between 1982 and 2010. In summary, and with reference to Table 18, anticipated AWDT traffic growth on the regional highway network is as follows:

1982-2010 Increase

Interstate Route 93:	19%
Mystic-Tobin Bridge:	9%
Storrow Drive:	8%
Callahan/Sumner Tunnels:	11%
Central Artery:	4%-10%
Massachusetts Turnpike:	12%
Southeast Expressway:	5%
Route 1A (North of Airport):	30%

Route 1A north of Logan Airport and Interstate Route 93 are both estimated to experience substantial increases in daily traffic during this period (30 percent and 19 percent respectively). Route 1A's increase reflects both the availability of excess highway capacity on this route and anticipated significant increases in airport-related traffic (traffic on the airport access/egress road system is forecast to increase by 48 percent over this same period). Interstate Route 93 also has excess capacity, and also serves as a "backdoor" route (Route 16 to Route 60 to Bell Circle) to the airport, both of which contribute to its high growth rate. Growth rates on the remaining facilities are 12 percent or less for this period, with the lowest rates (four to five percent) attributable to sections of the congested Southeast Expressway and Central Artery. Though congested in 1982, AWDT in the Callahan-Sumner Tunnels will increase by 11 percent, reflecting the significant growth in airport related traffic and the absence of alternative route choices for airport users bound from downtown Boston and points south and southwest of Boston.

Future AWDT Comparisons Among Alternatives. Comparison of forecast year 2010 AWDT volumes for the four build alternatives versus the No-Build Alternative yields the results contained in Table 19.

It should be noted that the AWDT's at the Fort Point Channel crossings of Summer Street, Congress Street, and Northern Avenue do not vary significantly between the No-Build and build alternatives for 1990 and 2010, suggesting little to no effects of the Third Harbor Tunnel (Table 18). This result seems especially incongruous for Summer Street, as the ramps to the Third Harbor Tunnel connect to that facility. These ramps will carry AWDT's in the 10-11,000 range for Alternatives 2 and 3 (on-ramp only) and in the 17-19,000 range for Alternatives 4 and 5 (includes both on- and off-ramps) in 2010. However, these AWDT's are representative of points to the east of the proposed relocated Dorchester Avenue (i.e., on the bridges themselves) and, for Summer Street, east of (on the South Boston side of) the Summer Street connections to the Third Harbor Tunnel. AWDT's for the build alternatives to the west of these proposed facilities will be higher than for the No-Build Alternative in all cases for 1990 and 2010, as exemplified by the following for 2010:

AWDT's West of Relocated Dorchester Avenue, 2010:

	No-Build	Alternatives 2 and 3	Alternatives 4 and 5
Summer Street	33,400	44,000	36,700
Congress Street	21,700	21,000	23,200
Northern Avenue	33,300	37,700	34,500

The AWDT's west of relocated Dorchester Avenue indicate a substantial use of Summer Street, Congress Street, and Northern Avenue by tunnel-oriented traffic destined to and from the downtown.

The lack of significant change between the No-Build and build

Table 18
AVERAGE WEEKDAY DAILY TRAFFIC (AWDT)
1982, 1990, 2010
ALL ALTERNATIVES

	1982	1990					2010				
ROADWAY LINKS	EXISTING	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
THIRD HARBOR TUNNEL	N/A	N/A	67,700	62,800	69,100	65,400	N/A	77,300	72,900	77,400	74,600
SUMNER/CALLAHAN TUNNEL	82,800	83,600	49,900	52,200	50,200	51,600	91,800	58,600	59,600	58,400	60,600
TOBIN BRIDGE-north of I-93 RAMPS	72,500	73,900	49,900	52,700	49,500	51,600	79,100	53,500	55,400	53,900	55,500
I-93-north of TOBIN BRIDGE RAMPS	89,450	102,200	107,000	108,000	107,300	106,600	106,000	111,800	111,000	113,000	112,000
CENTRAL ARTERY											
between I-93 & Storrow Dr. Ramps	142,100	148,300	135,100	139,300	135,700	134,400	153,800	141,000	140,000	144,400	141,600
between Causeway St. & Sumner/Callahan Tunnels	161,700	167,500	166,400	171,000	165,500	163,900	173,100	171,800	175,900	173,500	173,500
between Sumner/Callahan & High St. Ramps	164,500	169,300	138,300	141,500	137,900	138,600	173,400	143,500	144,600	146,000	146,200
between Atlantic Ave. & Beach St. Ramps	166,200	169,500	104,300	108,100	136,300	136,500	173,100	107,600	109,200	142,100	139,500
between Albany St. & Mass Ave. Ramps	153,700	167,200	162,800	167,500	173,000	170,600	169,400	172,400	169,600	178,400	132,600
S. E. EXPRESSWAY											
between Columbia Rs. & Southampton St. Ramps	162,300	168,000	170,000	164,400	169,900	170,000	170,900	174,100	172,600	173,200	172,400
south of Columbia Rd. Ramps	151,620	156,900	158,770	153,540	158,670	158,770	159,650	162,640	161,240	161,800	161,050
MASS. TURNPIKE-west of Central Artery	71,200	79,600	88,900	87,600	91,000	90,200	80,000	93,200	92,800	96,200	95,600
STORROW DR.-west of Copley Ramps	84,000	86,100	76,600	78,800	76,100	76,500	90,600	81,100	79,300	80,300	80,400
ROUTE 1A-north of Neptune Rd.	30,825	35,800	50,500	49,200	50,500	49,200	40,000	55,600	51,500	55,600	51,500
LOGAN AIRPORT ACCESS /EGRESS RDS. (Main)	55,450	66,300	72,000	54,600	72,000	54,600	82,100	97,400	60,400	97,400	60,400
PORTER ST.-between Cottage & Wellington Sts.	8,425	10,000	7,200	7,200	7,200	7,200	11,700	8,600	8,600	8,600	8,600
MAVERICK ST.-between Cottage & Orleans Sts.	4,200*	4,300*	4,300*	4,300*	4,300*	4,300*	4,700*	4,500*	4,500*	4,500*	4,500*
SUMNER ST.-between Orleans & Cottage Sts.	2,400*	2,500*	2,500*	2,500*	2,500*	2,500*	2,700*	2,700*	2,700*	2,700*	2,700*
MERIDIAN ST.-northwest of Condor St.	15,100	17,700	16,100	16,400	16,100	16,400	18,300	17,100	12,400	17,100	12,400
BENNINGTON ST.-west of Route 1A	19,125	20,000	21,205	21,205	21,205	21,205	21,100	21,165	22,485	21,165	22,485
COLUMBIA RD.-north of Columbia Circle	21,750	25,875	24,800	24,800	25,300	25,300	27,350	26,600	26,600	26,700	26,700
L STREET-north of Day Blvd.	12,325	13,825	13,625	13,625	13,450	13,450	14,150	13,725	13,725	13,775	13,775
EAST FIRST ST.-west of Summer St.	2,900	4,550	4,425	4,425	4,050	4,050	4,800	4,500	4,500	4,425	4,425
D STREET-southwest of Summer St.	6,500	9,925	9,350	9,350	9,375	9,375	10,900	10,100	10,100	10,700	10,700
SUMMER ST.-at Fort Point Channel	27,000	35,475	34,150	34,150	34,700	34,700	36,450	35,650	35,650	36,050	36,050
CONGRESS ST.-at Fort Point Channel	11,000	14,550	14,050	14,050	14,350	14,350	15,550	15,150	15,150	15,450	15,450
NORTHERN AVE.-at Fort Point Channel	18,050	30,250	28,900	28,900	29,450	29,450	32,350	31,550	31,550	31,900	31,900
DORCHESTER AVE.-south of A Street	23,450	25,450	23,800	23,800	25,250	25,250	25,650	25,650	25,650	25,450	25,450
DORCHESTER AVE.-south of Summer St.	N/A	N/A	25,200	25,200	24,500	24,500	N/A	27,400	27,400	28,250	28,250
FRONTAGE RD.-approach to W. Fourth St. Bridge	26,950*	27,200*	38,200*	27,400*	26,200*	27,900*	27,600*	35,800*	36,300*	27,600*	28,200*
WEST FOURTH STREET BRIDGE	11,000	10,650	9,500	9,500	9,050	9,050	10,650	10,400	10,400	8,550	8,550
BROADWAY BRIDGE	20,600	26,150	23,700	23,700	22,340	22,340	26,150	25,150	25,150	21,950	21,950
ATLANTIC AVE.-between Summer & Congress Sts.	16,900*	20,300*	22,600*	23,600*	15,700*	15,900*	20,700*	22,700*	23,100*	15,200*	16,800*
SEAPORT ACCESS RD.-southwest of Summer St.	N/A	8,300	7,350	7,350	8,100	8,100	9,300	8,900	8,900	9,100	9,100

* One-Way Volume

alternative AWDT's on these three facilities east of relocated Dorchester Avenue (and, for Summer Street, east of the tunnel ramps) reflects the offsetting effect of reduced through-traffic use of these three bridges (i.e., traffic attempting to escape Expressway/Central Artery congestion) and increased tunnel-oriented traffic use (from South Boston) under the build alternatives as compared to the No-Build. Some of this through traffic will remain on the Central Artery while a significant portion will use relocated Dorchester Avenue. The 27-28,000 AWDT on relocated Dorchester Avenue (south of Summer Street - Table 18) reflects, to some extent, this diversion of prior short-cutting through traffic from the three Fort Point Channel bridges, plus tunnel-accessing and local channel-oriented traffic circulation components.

On a daily basis, the Third Harbor Tunnel project will result in significant diversions (reductions) of traffic from the existing Callahan/Sumner Tunnels, in excess of 34 percent and from the Mystic-Tobin Bridge, in excess of 30 percent. A significant reduction in AWDT will also occur on the Central Artery south of the existing tunnels, 16 to 17 percent. Storrow Drive at its junction with the Central Artery will experience a 10 to 12 percent decrease. Significant increases (16 to 39 percent) will occur on Route 1A north of the airport and the Massachusetts Turnpike at the Central Artery, which are the termini of the Third Harbor Tunnel alternatives. AWDT changes on the remaining regional highway links will be seven percent or less.

Total harbor crossings (Mystic-Tobin Bridge, Callahan/Sumner Tunnels, and Third Harbor Tunnel) will increase by 16,800 vpd (vehicles per day) to 19,600 vpd daily, a 10 to 11 percent increase in harbor crossing traffic. This increase reflects both induced (new) traffic and traffic diverted from other local routes.

Table 19

YEAR 2010 AWDT:
BUILD VS. NO-BUILD COMPARISON
(Positive traffic change indicates Build volumes exceed No-Build)

Highway Section	Vehicles per day Change	% Change
Interstate Route 93	+4000 to +7000	+4 to +7
Mystic-Tobin Bridge*	-23600 to -25600	-30 to -32
Storrow Drive	-9500 to -11300	-10 to -12
Central Artery (No. of Tunnels)	-1300 to +2800	-1 to +2
Callahan-Sumner Tunnels*	-31200 to -33200	-34 to -36
Central Artery (So. of Tunnels)	-27200 to -29900	-16 to -17
Third Harbor Tunnel*	+72900 to +77300	----
Massachusetts Turnpike	+12800 to +16200	+16 to +20
Southeast Expressway (So. of Southampton)	+1500 to + 3200	+1 to +2
Route 1A (No. of Airport)	+11500 to +15600	+29 to +39
*NET CHANGE IN HARBOR CROSSINGS	+16800 to +19600	+10 to +11

Induced traffic is traffic added to the highway network which previously did not exist on that network, as a direct result of specific roadway improvements. It is different from diverted or redistributed traffic, which is already on the network but changes its routing as a result of more favorable travel times and/or distances occasioned by the roadway improvements. The new tunnel will provide improved cross-harbor circulation, capacity, and traffic operation. A main beneficiary of this improved cross-harbor traffic capability will be Logan Airport. Specifically, trips to and from the airport by airline passengers, visitors, and employees are susceptible to mode transfers from mass transit. Approximately 12,800 airport-oriented vehicle trips per day will be added to the highway network (induced) as a result of the Third Harbor Tunnel. These trips will be largely transfers from the MBTA's Blue Line; however, some will be the result of transfers from higher-occupancy vehicles (buses, taxis, limousines) to the lower-occupancy private automobile. Of the 12,800 induced trips, 70 percent (10,100) are estimated to be cross-harbor, with approximately 4200 using the existing Callahan/Sumner Tunnels and 5900 using the Third Harbor Tunnel.

The diverted traffic component of this increase in cross-harbor traffic (6700-9500 vpd) results from more traffic using the harbor facilities to gain access to the airport, rather than using local streets through Chelsea and East Boston, both because of the additional capacity and favorable route orientation of the new tunnel for some traffic (from the south/southwest), and the residual capacity and favorable route orientation of the existing tunnels for other traffic (from the north/northwest).

With the Third Harbor Tunnel project, residual traffic in the Callahan/Sumner Tunnels and on the Mystic-Tobin Bridge will be actually less than 1982 levels: 27 to 29 percent less in the case of the tunnels and 23 to 26 percent less in the case of the Bridge.

The differences in year 2010 AWDT between the build alternatives are 4400 vpd or less, a change of 6 percent or less. From Table 18, the railroad alignment alternatives (2 and 4) draw higher AWDT volumes than the airport alignment alternatives (3 and 5), but the differences are not significant.

<u>Local Streets</u>

<u>Traffic Growth Without the Project</u>. To summarize Section 3.1, analyses of anticipated traffic growth on local streets in South Boston, and East Boston without the proposed project between 1982 and 2010, the following conclusions can be made with reference to Table 18:

South Boston:

o AWDT increases of up to 80 percent will occur on selected roadway links between 1982 and 2010.

o The greatest AWDT increases (in excess of 35 percent) will occur on the Fort Point Channel bridges (Northern Avenue, Congress Street, Summer Street) and north-south routes (East First Street, D Street) which provide access to the northern industrial section of South Boston, which is anticipated to experience significant increases in development.

o AWDT increases on remaining selected roadway links will be less than 30 percent, and negligible changes (less than 10 percent) will occur on Dorchester Avenue south of A Street, Frontage Road, and West Fourth Street.

o The proposed Seaport Access Road (south of Summer Street) will carry 9300 vpd in 2010.

East Boston:

o As indicated previously, the

airport access/egress road system will experience a 48 percent increase in AWDT between 1982 and 2010, because of anticipated significant airport growth.

o Selected local roadway links (Bennington, Maverick, Sumner, and Meridian Streets) will experience increases in AWDT ranging from 10 to 21 percent.

o Porter Street, because of the airport influence, will experience a 39 percent increase in traffic.

Future AWDT Comparisons Among Alternatives. Except for Frontage Road (south of West Fourth Street), the West Fourth Street Bridge, and the Broadway Bridge, year 2010 AWDT volume differences between the four build alternatives in South Boston are less than 10 percent. Maximum differences for the above three select roadway links are as follows:

Build Alternative Maximum AWDT Differences:

o Frontage Road: 24% (Alt. 4 vs. Alt. 3)

o West Fourth Street Bridge: 18% (Alts. 4 & 5 vs. Alts. 2 & 3)

o Broadway Bridge: 13% (Alts. 4 & 5 vs. Alts. 2 & 3)

For these three selected local roadway links in South Boston, the two-way alignment options (Alternatives 4 and 5) are more effective in reducing AWDT volumes than the split-alignment options (Alternatives 2 and 3). Comparing the build alternatives to the No-Build Alternative in 2010, only the Frontage Road will experience an increase in AWDT which exceeds 1 percent as a result of the project (16 percent increase on the average for all four build alternatives; practically all selected links will experience decreases, some by as much as 10 percent on the average (Broadway and West Fourth Street Bridges).

In East Boston with the railroad alignment alternatives (2 and 4), AWDT's will be more than 60 percent higher as compared to the airport alignment alternatives for the airport access/egress road system and Meridian Street northwest of Condor Street. AWDT's on Porter, Maverick, and Sumner Streets will remain essentially the same among the four build alternatives. Comparing the build alternatives to the No-Build Alternative in 2010, AWDT's will generally decrease or remain approximately the same on most select local links, except for the airport access/egress road system under Alternatives 2 and 4 (railroad alignments); AWDT will increase by 19 percent on the latter.

Peak Hour Traffic

AM peak hour traffic volumes for the selected highway links, ramps, and intersections in the years 1982, 1990, and 2010, including build alternative volumes for the latter two periods, are summarized in Table 20. Table 21 summarizes the comparable volumes for the PM peak hour. Like the AWDT volume trends previously described, peak hour volumes will generally increase without the project (Alternative 1) between 1982 and 1990, and 1990 and 2010. A brief summary of their magnitudes follows, as they are subjected to rigorous v/c, level of service, and queuing analyses in the next five subsections.

Affected Highway Network

During the AM and PM peak hours, traffic volumes on some sections of the Southeast Expressway and Central Artery without the Third Harbor Tunnel project will increase by more than fifty percent between 1982 and 2010, despite the traffic congestion and queuing which presently occurs. The Southeast Expressway/Central Artery from Southampton Street northerly to the Dewey Square Tunnel (Kneeland Street) particularly will experience increased peak hour traffic pressures, both AM and PM and in both directions, aggravated by the increased traffic to and from the Massachusetts Turnpike

TABLE 20
FUTURE TRAFFIC VOLUMES
AM PEAK HOUR
1990, 2010

	1982	1990					2010				
	EXISTING	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
MAJOR HIGHWAY LINKS - NORTHBOUND											
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	7450	8780	8890	9740	9010	8930	9650	9580	9580	9690	9610
L2N. Frontage Road: Adjacent to Mass. Ave. Interchange	2580	2770	2470	2510	2580	2620	2810	2770	2850	2930	2770
L13N. S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA	NA	7750	7680	7870	7710	NA	8780	8740	8780	8780
L14N. S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA	NA	7870	7790	NA	NA	NA	8930	8890	NA	NA
L15N. Central Artery: Btwn. Connector C-T and Dorchester Ave. Off-Ramp	NA	NA	5320	5210	NA	NA	NA	6990	7260	NA	NA
L16N. Port Point Channel Tunnel: Before Merge with Central Artery Roadway	NA	NA	2090	2280	NA	NA	NA	2550	2320	NA	NA
L17N. Port Point Channel Tunnel: Btwn. Central Artery Entrance and Exit Roadways	NA	NA	5280	5320	NA	NA	NA	6420	6420	NA	NA
L18N. Central Artery Tunnel: After Third Harbor Tunnel Split	NA	NA	3610	3950	NA	NA	NA	4560	4830	NA	NA
L19N. Third Harbor Tunnel	NA	NA	1940	1520	1940	1520	NA	2130	1630	2130	1630
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	5780	7940	NA	NA	NA	NA	9420	NA	NA	NA	NA
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	6450	7410	NA	NA	6040	6160	9500	NA	NA	8320	8440
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	5030	5740	4640	5090	4450	4710	6420	5740	6160	5240	5510
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	5540	6000	5740	5850	5700	5660	7220	7710	7830	7300	7220
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	3660	3570	3080	3120	3380	3340	4790	4600	4670	4790	4670
L8N. Mystic Tobin Bridge: North of I-93 Ramps	1580	1900	1370	1440	1410	1520	2010	1630	1710	1670	1750
L9N. I-93: North of Tobin Bridge Ramps	2000	2240	2240	2280	2320	2320	2740	2810	2810	2890	2850
L10N. Callahan Tunnel	2300	2660	1370	1670	1370	1670	3150	1750	2170	1750	2170
L20N. S.E. Expressway: Btwn. Frontage On - and Third Harbor Tunnel Off-Ramp	NA	NA	NA	NA	8130	7980	NA	NA	NA	9120	9120
L21N. Port Point Channel Tunnel: Btwn. Expwy./Frontage Merge and Tpk. On-Ramp	NA	NA	NA	NA	1030	800	NA	NA	NA	1060	800
L22N. Port Point Channel Tunnel: Btwn. Turnpike On - and Summer St. On-Ramps	NA	NA	NA	NA	1520	1250	NA	NA	NA	1670	1370
L11N. Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	2050	2470	1290	1560	1290	1560	2890	1750	2280	1750	2280
L23N. Route 1A: Btwn. Third Harbor Tunnel On - and Airport On-Ramps	NA	NA	1290	NA	1290	NA	NA	1180	NA	1180	NA
L24N. Airport Tunnel: Btwn. Off-Ramp to Airport and Off-Ramp to Route 1A	NA	NA	NA	490	NA	490	NA	NA	380	NA	380
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	930	1220	1790	1560	1790	1560	1330	1820	1670	1820	1670
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND											
L1E: Mass. Turnpike, Eastbound; West of Expressway Ramps	4400	4830	4600	4560	5020	5020	4860	4520	4480	5050	5090
L1W: Mass. Turnpike, Westbound; West of Expressway Ramps	1450	2550	2850	2810	2580	2660	2700	2890	2890	2770	2740
L2E: Storrow Drive, Eastbound; West of Copley Square Ramps	3450	3460	3340	3460	3460	3420	3990	4100	4140	3950	3900
L2W: Storrow Drive, Westbound; West of Copley Square Ramps	2430	3340	2890	2930	3120	3080	3880	3840	3880	3870	3840
MAJOR HIGHWAY LINKS - SOUTHBOUND											
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	3370	5130	5320	5320	5240	5240	5660	5740	5740	5740	5740
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	3920	5700	5810	5810	5740	5780	6190	6270	6270	6230	6230
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	4540	5170	5400	5400	5210	5210	5400	5550	5510	5430	5470
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	4350	5620	NA	NA	NA	NA	6160	NA	NA	NA	NA
L16S. Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA	NA	4980	4980	4140	4140	NA	5130	5130	4290	4290
L17S. Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA	NA	3650	3610	NA	NA	NA	3720	3720	NA	NA
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	4730	5430	NA	NA	4450	4480	5700	NA	NA	4670	4750
L18S. Central Artery Local Rdwy: Btwn. Congress On - and Beach Off-Ramps	NA	NA	3530	3460	NA	NA	NA	3880	3800	NA	NA
L19S. Third Harbor Tunnel	NA	NA	2130	1900	2130	1900	NA	2200	2010	2200	2010
L20S. Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	990	1030	NA	NA	NA	1140	1180	NA	NA
L21S. Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	2510	2510	NA	NA	NA	2550	2550	NA	NA
L6S. Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	5050	5590	NA	NA	4640	4670	5850	NA	NA	4940	4940
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	5850	5740	NA	NA	4980	5020	6190	NA	NA	5320	5360
L22S. Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA	NA	5170	5020	NA	NA	NA	5240	5320	NA	NA
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	5570	5470	5360	5400	5400	5400	6080	6460	6570	6270	6270
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	5220	5170	4860	4900	4860	4940	6190	6120	6230	6080	6080
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	5430	4790	3990	4060	4370	4410	6190	5810	6000	6040	6040
L11S. Mystic Tobin Bridge: North of I-93 Ramps	3060	3340	2890	2960	2850	3000	3720	3150	3270	3150	3300
L12S. I-93: North of Tobin Bridge Ramps	3980	3460	3420	3460	3610	3530	4030	4100	4100	4030	4140
L13S. Sumner Tunnel	3160	3460	2130	2200	2130	2200	3690	2500	2550	2500	2550
L23S. Port Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA	NA	NA	NA	1180	1100	NA	NA	NA	1250	1180
L24S. Port Point Channel Tunnel: Btwn. Summer Off - and Mass. Tpk. Off-Ramps	NA	NA	NA	NA	1370	1330	NA	NA	NA	1480	1440
L14S. Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	1510	1630	1790	1860	1790	1860	1750	2170	2170	2170	2170
L25S. Route 1A: Btwn. Airport/Third Harbor Off - and Airport On-Ramps	NA	NA	840	990	840	990	NA	840	950	840	950
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	1750	1440	NA	NA	NA	NA	1440	NA	NA	NA	NA
L26S. Airport Tunnel Btwn. Porter On - and Airport On-Ramps	NA	NA	NA	1290	NA	1290	NA	NA	1250	NA	1250
L27S. Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA	NA	NA	3090	NA	3090	NA	NA	4170	NA	4170
L28S. Route 1A: Btwn. Neptune On-Ramp & Off-Ramp to Airport & Third Harbor Tunnel	NA	NA	3150	3000	3150	3000	NA	3150	3120	3150	3120
L29S. Connector: Route 1A to Third Harbor Tunnel and Airport	NA	NA	2320	2010	2320	2010	NA	2320	2170	2320	2170
MAJOR HIGHWAY RAMPS - NORTHBOUND											
R1N. Columbia Rd. Off; from S.E. Expressway	500	570	680	680	650	680	680	610	680	680	680
R2N. Mass. Avenue On; to S.E. Expressway	460	1520	1330	1370	1330	1290	2010	1980	2050	1860	1820
R12N. Ramp NA: S.E. Expressway to Port Point Channel Tunnel	NA	NA	NA	NA	1520	1330	NA	NA	NA	680	650
R13N. Ramp NS: Frontage Rd. to Port Point Channel Tunnel	NA	NA	NA	NA	380	300	NA	NA	NA	460	340
R14N. Dorchester Ave. Off; from Port Point Channel Tunnel	NA	NA	2130	2170	870	840	NA	3120	3150	*	*
R15N. Ramp ET: Mass. Tpk. to Port Point Channel Tunnel	NA	NA	NA	NA	490	460	NA	NA	NA	650	530
R16N. Summer St. On; to Third Harbor Tunnel	NA	NA	270	150	460	270	NA	270	300	460	270
R3N. Mass. Tpk. On; to Central Artery	1600	1750	NA	NA	1520	1560	2320	NA	NA	2090	2130
R4N. Atlantic Ave. Off; from Central Artery	2360	3840	NA	NA	3500	3460	4340	NA	NA	4830	4710
R5N. Atlantic Ave. On; to Central Artery	220	840	1030	1140	570	650	800	1220	1330	570	650
R6N. Callahan Tunnel Off; from Central Artery	1330	1250	270	610	150	490	1330	190	570	110	490
R7N. Sumner Tunnel On; to Central Artery	1420	1560	1330	1370	1440	1440	2130	2170	2240	2200	2200
R8N. Storrow Drive Off; from Central Artery	1900	1820	1630	1710	1710	1710	2470	2550	2660	2510	2470
R9N. Storrow Drive On; to Central Artery	1200	*	650	650	720	720	*	950	950	1030	1030
R17N. Connector C-T: Central Artery to Mass. Tpk./Kneeland St.	NA	NA	2550	2580	NA	NA	NA	1940	1630	NA	NA
R18N. Ramp S-C: Frontage Rd. to Port Point Channel	NA	NA	1370	1600	NA	NA	NA	1710	1480	NA	NA

* = Inconsistent Data

NA = Not Applicable for this Alternative

TABLE 20 (CONTINUED)
FUTURE TRAFFIC VOLUMES
AM PEAK HOUR
1990, 2010

	1982	1990					2010				
	EXISTING	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
MAJOR HIGHWAY RAMPS - NORTHBOUND (Continued)											
R19N. Connector T-C: Mass. Tpk. to Fort Point Channel Tunnel	NA	NA	720	720	NA	NA	NA	840	840	NA	NA
R10N. Airport Off; from Routa 1A	1390	1710	950	950	950	950	2130	1370	1600	1370	1600
R11N. Airport On; to Route 1A	270	460	490	NA	490	NA	570	650	NA	650	NA
R20N. Ramp AP-1: Third Harbor Tunnel to Airport	NA	NA	990	1030	990	1030	NA	1330	1250	1330	1250
R21N. Ramp 1A-1: Third Harbor Tunnel to Route 1A	NA	NA	950	490	950	490	NA	800	380	800	380
R22N. Airport/Third Harbor Tunnel On: to Routa 1A	NA	NA	NA	950	NA	950	NA	NA	990	NA	990
MAJOR HIGHWAY RAMPS - SOUTHBOUND											
R1S. Columbia Rd. On; to S.E. Expressway	400	*	*	*	*	*	*	*	*	*	*
R2S. Mass. Ave. Off; from S.E. Expressway	720	*	*	*	*	*	*	*	*	*	*
R3S. Albany St. On; to S.E. Expressway	600	490	420	420	420	420	490	420	380	420	460
R13S. Ramp SA: Fort Point Channel Tunnel to S.E. Expressway	NA	NA	NA	NA	650	650	NA	NA	NA	720	720
R14S. Ramp SS: Fort Point Channel Tunnel to Albany St.	NA	NA	NA	NA	490	460	NA	NA	NA	530	460
R15S. Ramp 4T: Fort Point Channel Tunnel to Mass. Tpk.	NA	NA	NA	NA	190	230	NA	NA	NA	230	300
R16S. Summer St. Off: from Fort Point Channel Tunnel	NA	NA	NA	NA	760	570	NA	NA	NA	720	570
R4S. Mass. Tpk./Albany St. Off; from Central Artery	1260	*	1480	1520	1140	1180	*	1860	1900	1370	1370
R17S. Ramp A: Mass. Tpk./Kneeland St. to Central Artery	NA	NA	1370	1370	NA	NA	NA	1410	1370	NA	NA
R5S. Dewey Sq. Off; from Central Artery	750	720	530	490	610	610	840	490	420	720	720
R6S. High St. Off; from Central Artery	1300	1100	NA	NA	1030	1030	1330	NA	NA	1220	1180
R18S. Congress St. On: to Central Artery	NA	NA	840	840	NA	NA	NA	910	950	NA	NA
R19S. Ramp C-P: Central Artery to Purchase St.	NA	NA	1670	1480	NA	NA	NA	1560	1600	NA	NA
R7S. Haymarket On; to Central Artery	1560	1750	1400	1220	990	990	2050	1140	1100	990	1030
R8S. Callahan Tunnel Off; from Central Artery	1280	1520	1600	1600	1410	1410	1940	2360	2360	1940	1940
R9S. Storrow Drive On; to Central Artery	1500	2050	2280	2280	2010	2090	2130	2320	2320	2170	2130
R10S. Storrow Drive Off; from Central Artery	1720	1630	1400	1440	1560	1560	2130	2010	2090	2130	2130
R11S. Airport Off; from Route 1A	770	870	840	870	840	870	1030	950	1030	950	1030
R12S. Airport On; to Route 1A	530	1060	950	870	950	870	1330	1330	1220	1330	1220
R20S. Ramp 1A-2: Route 1A to Third Harbor Tunnel	NA	NA	1480	1140	1480	1140	NA	1370	1140	1370	1140
R21S. Ramp AP-2: Airport to Third Harbor Tunnel	NA	NA	NA	610	NA	610	NA	NA	760	NA	760
R22S. Ramp AP-3: Airport to Third Harbor Tunnel	NA	NA	650	NA	650	NA	NA	800	NA	800	NA
INTERSECTIONS											
South Boston											
1. Columbia Circle	5260	6150	4880	4880	4850	4850	6200	5000	5000	4980	4980
2. Andrew Square	2000	3070	2890	2890	2800	2800	3160	3190	3190	3260	3260
3. Columbia Rd./Day Blvd./L St.	1390	1370	1350	1350	1290	1290	1370	1480	1480	1390	1390
4. L St./East First St./Summer St.	1500	1890	1810	1810	1700	1700	1910	1940	1940	1810	1810
5. Dorchester Ave./W. 5th St./A St.	2300	2410	1960	1960	2330	2330	2440	2330	2330	2580	2580
6. Dorchester Ave./W. 4th St.	2230	2390	1960	1960	2260	2260	2450	2300	2300	2450	2450
7. Dorchester Ave./W. Broadway	2650	2690	2230	2230	2380	2380	2790	2610	2610	2470	2470
8. Summer St./Dorchester Ave.	2650	3120	4610	4610	4050	4050	3140	5770	5770	4360	4360
9. Summer St./Melcher St.	2340	2800	2940	2940	2940	2940	2770	3020	3020	2900	2900
10. Summer St./D St.	2380	2610	2220	2220	2200	2200	2410	2440	2440	2040	2040
11. Congress St./Dorchester Ave.	2020	2300	3940	3940	2680	2680	*	5070	5070	2810	2810
12. Congress St./A St.	950	1240	1530	1530	1240	1240	1240	1600	1600	1240	1240
13. Northern Ave./Sleeper St.	1270	2660	1830	1830	2110	2110	2690	1720	1720	2290	2290
14. Herald St./Broadway/Frontage Rd./Albany St.	3670	4910	4340	4340	4290	4290	4960	4500	4500	4700	4700
15. Berkeley St./W. Fourth St./Frontage Rd./Albany St.	4530	5910	5360	5360	5620	5620	6090	5330	5330	5960	5960
East Boston and Revere											
16. Sumner St./Meridian St./Chelsea St.	620	690	720	740	720	740	690	830	760	830	760
17. Sumner St./Bremen St.	460	520	460	560	460	560	460	430	460	430	560
18. Maverick St./Meridian St./Chelsea St.	880	830	1560	1130	1560	1130	830	1050	1030	1050	1030
19. Maverick St./Bremen St.	480	480	480	480	480	480	480	480	480	480	480
20. Maverick St./Jeffries St./Airport Access Rd.	380	380	330	310	330	310	380	380	380	380	380
21. Porter St./Chelsea St./Visconti Rd.	1560	2120	1090	1090	1090	1090	2430	1480	1460	1480	1460
22. Porter St./Bremen St.	980	1000	730	790	730	790	1220	910	850	910	850
23. Porter St./Orleans St.	570	820	560	640	560	640	1020	720	780	720	780
24. Porter St./Cottage St.	540	770	540	550	540	550	990	730	720	730	720
25. Central Square	1000	1170	1200	1260	1200	1260	1260	1340	1340	1340	1340
26. Porter St./London St.	950	930	480	590	480	590	1060	820	700	820	700
27. Bennington St./Prescott St.	1150				NO DATA AVAILABLE						
28. Chelsea St./East Eagle St.	1070	910	1010	1040	1010	1040	1020	1120	1160	1120	1160
29. Bennington St./Neptune Rd.	2370				NO DATA AVAILABLE						
30. McClellan Off-Ramp/Neptune Rd.	920	1000	1090	1170	1090	1170	1140	1240	1320	1240	1320
31. Condor St./Meridian St.	1070	1300	1300	1400	1300	1400	1470	1520	1530	1520	1530
32. Airport Crossover Roads	3630	5380	6910	4280	6910	4280	6640	9050	5970	9050	5970
33. Bell Circle (Revere)	3860	4760	5170	5130	5170	5130	4870	5260	5190	5260	5190
Downtown											
34. Kneeland St./Surface Artery/S.B. On-Ramp	2550	3650	3040	3000	2980	3010	3370	2580	2700	2990	3010
35. Dewey Square	3770	*	5450	5360	5070	5080	5870	5040	4990	4880	4800
36. Atlantic Ave./Congress St.	3040	*	4580	4580	4620	4660	4490	4340	4330	3800	3850
37. Atlantic Ave./Northern Ave.	2440	*	5410	4890	4550	4740	4740	5760	5850	4100	4440
38. Atlantic Ave./Surface Artery/High St.	3220	5700	4860	3750	4900	5030	6230	5050	5050	5700	5780
39. Purchase St./Congress St.	2250	2400	3250	3280	2050	2110	2620	3430	3460	2050	2170
40. North St./Blackstone St./S.B. Off-Ramp	2710	4040	4060	3330	3720	3710	4580	4610	4650	3950	3980
41. Cross St./Hanover St./Salem St.	2070	2840	1600	1650	1610	1690	2680	1430	1420	1470	1530
42. Leverett Circle	6720	6860	7340	7330	6520	6680	6560	6960	6980	6510	6910
43. Dorchester Ave./Northern Ave.	NA	NA	3110	3110	3170	3170	NA	3940	3940	3330	3330
44. Summer St./Fort Point Channel Tunnel Ramps	NA	NA	NA	NA	3330	3330	NA	NA	NA	3290	3290

* = Inconsistent Data

NA = Not Applicable for this Alternative

NOTE: Intersection Volumes are Total Approach Volumes

TABLE 21
FUTURE TRAFFIC VOLUMES
PM PEAK HOUR
1990, 2010

MAJOR HIGHWAY LINKS - NORTHBOUND

Link	1982 EXISTING	1990 ALT. 1	1990 ALT. 2	1990 ALT. 3	1990 ALT. 4	1990 ALT. 5	2010 ALT. 1	2010 ALT. 2	2010 ALT. 3	2010 ALT. 4	2010 ALT. 5
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	4350	6030	6140	6140	6110	6110	6590	6660	6660	6660	6660
L2N. Frontage Road, Adjacent to Mass. Ave. Interchange	1700	1630	1370	1370	1480	1550	1590	1590	1550	1670	1670
L13N. S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA	NA	5510	5510	5220	5220	NA	5960	5960	5620	5620
L14N. S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA	NA	5510	5510	NA	NA	NA	6000	6000	NA	NA
L15N. Central Artery: Btwn. Connector C-T and Dorchester Ave. Off-Ramp	NA	NA	4000	4070	NA	NA	NA	4370	4330	NA	NA
L16N. Fort Point Channel Tunnel: Before Merge with Central Artery Roadway	NA	NA	2040	2000	NA	NA	NA	2180	2220	NA	NA
L17N. Fort Point Channel Tunnel: Btwn. Central Artery Entrance and Exit Roadways	NA	NA	5070	5100	NA	NA	NA	5550	5550	NA	NA
L18N. Central Artery Tunnel: After Third Harbor Tunnel Split	NA	NA	3510	3550	NA	NA	NA	3590	3590	NA	NA
L19N. Third Harbor Tunnel	NA	NA	2660	2300	2660	2300	NA	2960	2660	2320	2660
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	3920	5850	NA	NA	NA	NA	6360	NA	NA	NA	NA
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	4200	5620	NA	NA	4440	4550	5550	NA	NA	4630	4740
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	4080	5740	5270	5330	4960	5030	6030	5400	5370	4630	5220
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	4700	5810	6180	6110	6110	5920	6070	6660	6480	6030	6220
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	5350	*	4260	4550	4180	4550	*	5220	5480	5000	4850
L8N. Mystic Tobin Bridge: North of I-93 Ramps	3120	3400	2850	2920	2810	2920	3590	3070	3220	3070	3070
L9N. I-93: North of Tobin Bridge Ramps	4290	4290	4480	4220	4260	4180	4400	4740	4770	4700	4140
L10N. Callahan Tunnel	2850	3740	1960	2220	1960	2220	4070	2330	2520	2330	2520
L20N. S.E. Expressway: Btwn. Frontage On - and Third Harbor Tunnel Off-Ramp	NA	NA	NA	NA	5290	5250	NA	NA	NA	5700	5770
L21N. Fort Point Channel Tunnel: Btwn. Exprwy./Frontage Merge and Tpk. On-Ramp	NA	NA	NA	NA	1180	1110	NA	NA	NA	1410	1370
L22N. Fort Point Channel Tunnel: Btwn. Turnpike On - and Summer St. On-Ramps	NA	NA	NA	NA	1590	1550	NA	NA	NA	1890	1890
L11N. Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	2580	3330	1810	2150	1810	2150	3590	2040	2410	2040	2410
L23N. Route 1A: Btwn. Third Harbor Tunnel On - and Airport On-Ramps	NA	NA	2410	NA	2410	NA	NA	2290	NA	2290	NA
L24N. Airport Tunnel: Btwn. Off-Ramp to Airport and Off-Ramp to Route 1A	NA	NA	NA	1110	NA	1110	NA	NA	1150	NA	1150
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	2230	2440	3300	3150	3300	3150	2700	3400	3370	3400	3370

MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND

Link	1982 EXISTING	1990 ALT. 1	1990 ALT. 2	1990 ALT. 3	1990 ALT. 4	1990 ALT. 5	2010 ALT. 1	2010 ALT. 2	2010 ALT. 3	2010 ALT. 4	2010 ALT. 5
L1E: Mass. Turnpike, Eastbound; West of Expressway Ramps	2080	2520	2630	2700	2740	2740	2920	2850	2890	2920	3030
L1W: Mass. Turnpike, Westbound; West of Expressway Ramps	3180	3400	2920	3850	3700	3660	3660	4180	4140	3850	4000
L2E: Storrow Drive, Eastbound; West of Copley Square Ramps	2600	3000	2920	2890	2960	2890	3110	3070	3000	3030	3110
L2W: Storrow Drive, Westbound; West of Copley Square Ramps	3440	3960	3770	3770	3810	3920	4030	4370	4260	4220	4140

MAJOR HIGHWAY LINKS - SOUTHBOUND

Link	1982 EXISTING	1990 ALT. 1	1990 ALT. 2	1990 ALT. 3	1990 ALT. 4	1990 ALT. 5	2010 ALT. 1	2010 ALT. 2	2010 ALT. 3	2010 ALT. 4	2010 ALT. 5
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	5350	8290	8580	8580	8550	8550	8770	9100	9100	8990	8990
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	6150	9360	9550	9550	9580	9580	10430	10100	10100	9990	9990
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	5750	8360	9070	9070	8840	8840	8700	9400	9400	9100	9100
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	4570	8070	NA	NA	NA	NA	8330	NA	NA	NA	NA
L16S. Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA	NA	7770	7590	6510	6510	NA	7920	7770	6620	6850
L17S. Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA	NA	5440	5330	NA	NA	NA	5550	5480	NA	NA
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	4500	6550	NA	NA	5920	5920	6880	NA	NA	6070	6110
L18S. Central Artery Local Rdwy: Btwn. Congress On - and Beach Off-Ramps	NA	NA	4070	4000	NA	NA	NA	4370	4370	NA	NA
L19S. Third Harbor Tunnel	NA	NA	2070	1920	2070	1920	NA	2410	2370	2410	2370
L20S. Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	480	410	NA	NA	NA	480	440	NA	NA
L21S. Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	3630	3590	NA	NA	NA	3740	3740	NA	NA
L6S. Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	3880	5960	NA	NA	5110	5140	6140	NA	NA	5290	5290
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	3530	5220	NA	NA	4510	4590	5400	NA	NA	4740	4700
L22S. Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA	NA	4920	4920	NA	NA	NA	5180	5110	NA	NA
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	3350	4850	4370	4740	4440	4700	5180	5290	5370	5220	4700
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	2740	4140	3810	4070	3850	4030	4180	4480	4660	4370	4400
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	3710	4030	3660	3850	3590	3920	4000	4660	4850	4440	4330
L11S. Mystic Tobin Bridge: North of I-93 Ramps	2180	2220	1630	1780	1550	1810	2480	1780	1960	1700	1850
L12S. I-93: North of Tobin Bridge Ramps	2150	2850	2890	2850	2850	2890	3000	3370	3400	3290	3180
L13S. Sumner Tunnel	2640	2810	1590	1480	1590	1480	3260	1960	1810	2040	1810
L23S. Fort Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA	NA	NA	NA	1180	1070	NA	NA	NA	1300	1260
L24S. Fort Point Channel Tunnel: Btwn. Summer Off - and Mass. Tpk. Off-Ramps	NA	NA	NA	NA	1520	1410	NA	NA	NA	1740	1740
L14S. Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	1930	1780	1480	1370	1480	1370	2070	1850	1700	1850	1700
L25S. Route 1A: Btwn. Airport/Third Harbor Off - and Airport On-Ramps	NA	NA	300	370	300	370	NA	330	370	330	370
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	1620	1040	NA	NA	NA	NA	1150	NA	NA	NA	NA
L26S. Airport Tunnel Btwn. Porter On - and Airport On-Ramps	NA	NA	NA	890	NA	890	NA	NA	930	NA	930
L27S. Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA	NA	NA	3160	NA	3160	NA	NA	4100	NA	4100
L28S. Route 1A: Btwn. Neptune On-Ramp & Off-Ramp to Airport & Third Harbor Tunnel	NA	NA	1960	1740	1960	1740	NA	2180	1920	2180	1920
L29S. Connector: Route 1A to Third Harbor Tunnel and Airport	NA	NA	1670	1370	1670	1370	NA	1850	1550	1850	1550

MAJOR HIGHWAY RAMPS - NORTHBOUND

Ramp	1982 EXISTING	1990 ALT. 1	1990 ALT. 2	1990 ALT. 3	1990 ALT. 4	1990 ALT. 5	2010 ALT. 1	2010 ALT. 2	2010 ALT. 3	2010 ALT. 4	2010 ALT. 5
R1N. Columbia Rd. Off; from S.E. Expressway	260	*	*	*	*	*	330	190	190	190	190
R2N. Mass. Avenue On; to S.E. Expressway	200	700	850	850	630	630	700	1110	1110	740	740
R12N. Ramp NA: S.E. Expressway to Fort Point Channel Tunnel	NA	NA	NA	NA	810	810	NA	NA	NA	960	960
R13N. Ramp NS: Frontage Rd. to Fort Point Channel Tunnel	NA	NA	NA	NA	370	330	NA	NA	NA	480	410
R14N. Dorchester Ave. Off; from Fort Point Channel Tunnel	NA	NA	960	960	*	*	NA	1000	1000	*	*
R15N. Ramp ST: Mass. Tpk. to Fort Point Channel Tunnel	NA	NA	NA	NA	410	410	NA	NA	NA	520	520
R16N. Summer St. On; to Third Harbor Tunnel	NA	NA	1070	740	1070	780	NA	1040	780	1040	780
R3N. Mass. Tpk. On; to Central Artery	700	700	NA	NA	1070	1180	630	NA	NA	1150	1220
R4N. Atlantic Ave. Off; from Central Artery	1540	2110	NA	NA	1550	1590	1700	NA	NA	1850	1700
R5N. Atlantic Ave. On; to Central Artery	800	1000	1780	1780	1040	1110	1150	1810	1780	960	1180
R6N. Callahan Tunnel Off; from Central Artery	730	1410	440	520	260	520	1550	410	520	260	520
R7N. Sumner Tunnel On; to Central Artery	1350	1520	1330	1300	1410	1370	1590	1670	1630	1670	1520
R8N. Storrow Drive Off; from Central Artery	1100	1630	1590	1700	1810	1740	1670	1630	1520	1570	1920
R9N. Storrow Drive On; to Central Artery	2000	*	1330	1440	1330	1440	*	1590	1700	1550	1520
R17N. Connector C-T: Central Artery to Mass. Tpk./Kneeland St.	NA	NA	1520	1440	NA	NA	NA	1630	1590	NA	NA
R18N. Ramp S-C: Frontage Rd. to Fort Point Channel	NA	NA	1520	1440	NA	NA	NA	1590	1550	NA	NA

* = Inconsistent Data

NA = Not Applicable for this Alternative

TABLE 21 (CONTINUED)
FUTURE TRAFFIC VOLUMES
PM PEAK HOUR
1990, 2010

	1982	1990					2010				
	EXISTING	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
MAJOR HIGHWAY RAMPS - NORTHBOUND (Continued)											
R19N. Connector T-C: Mass. Tpk. to Fort Point Channel Tunnel	NA	NA	520	560	NA	NA	NA	590	670	NA	NA
R10N. Airport Off: from Route 1A	1270	1850	1070	1040	1070	1040	2110	1330	1150	1330	1150
R11N. Airport On: to Route 1A	320	960	[illegible]	NA	390	NA	1220	1110	NA	1110	NA
R20N. Ramp AP-1: Third Harbor Tunnel to Airport	NA	NA	1000	1180	1000	1180	NA	1370	1520	1370	1520
R21N. Ramp 1A-1: Third Harbor Tunnel to Route 1A	NA	NA	1660	1110	1660	1110	NA	1550	1150	1550	1150
R22N. Airport/Third Harbor Tunnel On: to Route 1A	NA	NA	NA	2040	NA	2040	NA	NA	2300	NA	2300
MAJOR HIGHWAY RAMPS - SOUTHBOUND											
R1S. Columbia Rd. On: to S.E. Expressway	1900	*	850	850	810	810	*	850	950	850	850
R2S. Mass. Ave. Off: from S.E. Expressway	500	*	480	480	300	300	*	520	520	300	300
R3S. Albany St. On: to S.E. Expressway	1900	2290	1300	1300	2330	2330	1630	1480	1480	2480	2480
R13S. Ramp SA: Fort Point Channel Tunnel to S.E. Expressway	NA	NA	NA	NA	890	780	NA	NA	NA	1000	960
R14S. Ramp SS: Fort Point Channel Tunnel to Albany St.	NA	NA	NA	NA	260	300	NA	NA	NA	300	300
R15S. Ramp 4T: Fort Point Channel Tunnel to Mass. Tpk.	NA	NA	NA	NA	330	330	NA	NA	NA	440	480
R16S. Summer St. Off: from Fort Point Channel Tunnel	NA	NA	NA	NA	560	520	NA	NA	NA	670	630
R4S. Mass. Tpk./Albany St. Off: from Central Artery	1300	*	1700	1700	1440	1440	*	1960	2000	1590	1520
R17S. Ramp A: Mass. Tpk./Kneeland St. to Central Artery	NA	NA	2330	2260	NA	NA	NA	2370	2290	NA	NA
R5S. Dewey Sq. Off: from Central Artery	480	520	370	300	520	560	370	370	370	560	480
R6S. High St. Off: from Central Artery	550	560	NA	NA	520	520	520	NA	NA	560	520
R18S. Congress St. On: to Central Artery	NA	NA	1890	1890	NA	NA	NA	1920	1920	NA	NA
R19S. Ramp C-P: Central Artery to Purchase St.	NA	NA	850	930	NA	NA	NA	960	930	NA	NA
R7S. Haymarket On: to Central Artery	1890	1740	1670	1440	1330	1180	1670	1330	1370	1110	1330
R8S. Callahan Tunnel Off: from Central Artery	1710	1370	1110	1260	1260	1330	1440	1480	1630	1630	1590
R9S. Storrow Drive On: to Central Artery	850	1150	1700	1180	1150	1110	1180	930	1000	960	1110
R10S. Storrow Drive Off: from Central Artery	1820	*	890	960	890	960	*	1110	1150	1040	1040
R11S. Airport Off: from Route 1A	530	670	670	670	670	670	850	850	850	850	850
R12S. Airport On: to Route 1A	850	1400	1180	1000	1180	1000	1780	1520	1330	1520	1330
R20S. Ramp 1A-2: Route 1A to Third Harbor Tunnel	NA	NA	1000	700	1000	700	NA	1000	700	1000	700
R21S. Ramp AP-2: Airport to Third Harbor Tunnel	NA	NA	NA	1040	NA	1040	NA	NA	1440	NA	1440
R22S. Ramp AP-3: Airport to Third Harbor Tunnel	NA	NA	1070	NA	1070	NA	NA	1410	NA	1410	NA
INTERSECTIONS											
South Boston											
1. Columbia Circle	4340	5030	4290	4290	4480	4480	5710	4680	4680	4750	4750
2. Andrew Square	1650	2980	2750	2750	2990	2990	3210	2990	2990	3030	3030
3. Columbia Rd./Day Blvd./L St.	1450	1480	1390	1390	1460	1460	1530	1480	1480	1520	1520
4. L St./East First St./Summer St.	1550	1810	1390	1390	1460	1460	1860	1480	1480	1520	1520
5. Dorchester Ave./W. 5th St./A St.	2140	2200	1950	1950	1980	1980	2550	2020	2020	2150	2150
6. Dorchester Ave./W. 4th St.	2060	2100	1860	1860	1660	1660	2310	1960	1960	1750	1750
7. Dorchester Ave./W. Broadway	2750	*	1980	1980	1970	1970	*	2170	2170	2090	2090
8. Summer St./Dorchester Ave.	2400	4060	4920	4920	4960	4960	4080	5320	5320	5120	5120
9. Summer St./Melcher St.	2040	2960	2810	2810	3000	3000	3040	2820	2820	2910	2910
10. Summer St./D St.	2220	2570	2550	2550	2610	2610	2600	2490	2490	2650	2650
11. Congress St./Dorchester Ave.	1730	3390	4320	4320	3980	3980	3540	4680	4680	4190	4190
12. Congress St./A St.	1080	2010	1920	1920	1440	1440	2150	2020	2020	1520	1520
13. Northern Ave./Sleeper St.	1730	2370	2020	2020	2130	2130	2410	2060	2060	2210	2210
14. Herald St./Broadway/Frontage Rd./Albany St.	4140	4330	4060	4060	4850	4850	5000	4510	4510	5250	5250
15. Berkeley St./W. Fourth St./Frontage Rd./Albany St.	4410	6440	4700	4700	5030	5030	5700	5330	5330	5550	5550
East Boston and Revere											
16. Sumner St./Meridian St./Chelsea St.	720	880	720	870	720	870	890	890	890	890	890
17. Sumner St./Bremen St.	550	550	530	550	530	550	550	550	550	550	550
18. Maverick St./Meridian St./Chelsea St.	990	1030	1180	1230	1180	1230	1060	1130	1230	1130	1230
19. Maverick St./Bremen St.	510	540	540	540	540	540	540	510	510	510	510
20. Maverick St./Jeffries St./Airport Access Rd.	320	320	300	320	300	320	320	310	300	310	300
21. Porter St./Chelsea St./Visconti Rd.	1500	1850	1030	1010	1030	1010	2170	1270	1270	1270	1270
22. Porter St./Bremen St.	1290	1320	620	890	620	890	1510	960	1060	960	1060
23. Porter St./Orleans St.	790	880	510	620	510	620	1030	660	770	660	770
24. Porter St./Cottage St.	670	810	460	510	460	510	970	600	680	600	680
25. Central Square	1040	1210	1210	1210	1210	1210	1230	1230	1230	1230	1230
26. Porter St./London St.	670	840	480	570	480	570	990	520	520	520	520
27. Bennington St./Prescott St.	930	NO DATA AVAILABLE									
28. Chelsea St./East Eagle St.	1190	940	850	850	850	850	1130	920	620	920	620
29. Bennington St./Neptune Rd.	1890	NO DATA AVAILABLE									
30. McClellan Off-Ramp/Neptune Rd.	1460	1330	1330	1160	1330	1160	1460	1300	1330	1300	1330
31. Condor St./Meridian St.	1330	1330	1330	1330	1330	1330	1630	1330	1330	1330	1330
32. Airport Crossover Roads	4860	6390	7960	4870	7960	4870	7870	10250	6320	10250	6320
33. Bell Circle (Revere)	4470	5150	5360	5360	5360	5360	5420	5700	5700	5700	5700
Downtown											
34. Kneeland St./Surface Artery/S.B. On-Ramp	3240	4010	3530	3440	3820	3920	3990	3340	3620	4320	4120
35. Dewey Square	4890	*	4950	4960	4920	4870	6280	5300	5300	4590	5000
36. Atlantic Ave./Congress St.	2740	*	4000	3930	3650	3690	4790	4120	4160	3600	3870
37. Atlantic Ave./Northern Ave.	3560	*	4750	4860	3290	3480	4440	4940	5070	3610	3590
38. Atlantic Ave./Surface Artery/High St.	3420	4220	4360	4400	3150	3150	4070	4510	4920	3520	3480
39. Purchase St./Congress St.	2970	2960	4030	4130	2870	2930	3140	4230	4340	3000	2460
40. North St./Blackstone St./S.B. Off-Ramp	3540	4000	3530	3670	3690	3730	4400	3540	3680	3530	3430
41. Cross St./Hanover St./Salem St.	2110	2360	1350	1250	1280	1200	2610	1500	1510	1520	1410
42. Leverett Circle	6260	6420	6010	6430	6240	6430	6770	6230	6200	6330	7160
43. Dorchester Ave./Northern Ave.	NA	NA	2400	2400	2540	2540	NA	2620	2620	2800	2800
44. Summer St./Fort Point Channel Tunnel Ramps	NA	NA	NA	NA	3320	3320	NA	NA	NA	3270	3270

* = Inconsistent Data

NA = Not Applicable for this Alternative

NOTE: Intersection Volumes are Total Approach Volumes

interchange. Peak hour traffic volumes without the Third Harbor Tunnel project are expected to increase by approximately 40 percent in the Callahan Tunnel and 20 percent in the Sumner Tunnel between 1982 and 2010. For the Mystic-Tobin Bridge, peak hour volumes will increase by approximately 15 to 25 percent.

The Third Harbor Tunnel project will reduce peak hour traffic volumes in both peak hours in the year 2010, compared to the No-Build, by as much as the following:

Callahan Tunnel: 40-45 percent reduction.

Sumner Tunnel: 30-45 percent reduction.

Mystic-Tobin Bridge: 15-30 percent reduction.

Central Artery South of the Existing Tunnels: 15-20 percent reduction.

The relative differences in traffic reduction effectiveness between the build alternatives are not generally significant; however, the railroad alignment alternatives (2 and 4) are somewhat more effective than the airport alignment alternatives (3 and 5) with regard to the above regional highway sections. For a given East Boston alignment (railroad or airport), the split and two-way options result in approximately the same peak hour traffic reductions in comparison to the No-Build Alternative.

Local Streets/Intersections

In South Boston, peak hour traffic volume increases without the project between 1982 and 2010 will be most significant (in excess of 50 percent increase) at Andrew Square during both peak hours, and at the intersections of Dorchester Avenue with Summer and Congress Streets during the PM peak hour, indicating, in the first case, that traffic will continue to attempt to bypass Southeast Expressway/Central Artery congestion by using Dorchester Avenue in South Boston, and, in the second case, the increased traffic that will accompany the increased development in South Boston's northern industrial sector. The Herald Street/Broadway/ Frontage Road/Albany Street and Berkeley Street/West Fourth Street/Frontage Road/Albany Street intersections will also feel the effects of spillover Central Artery traffic during both peak hours, with increases without the project between 1982 and 2010 of 20 to 35 percent.

With the build alternatives in 2010, peak hour volumes through Columbia Circle, Andrew Square, L Street/East First Street/Summer Street, Dorchester Avenue/West 5th Street/A Street, Dorchester Avenue/West Fourth Street, Dorchester Avenue/West Broadway, Summer St./D Street, Northern Avenue/Sleeper Street, Herald Street/Broadway/ Frontage Road/Albany Street, and Berkeley Street/West Fourth Street/Frontage Road/Albany Street will generally remain the same or decrease as compared to the No-Build Alternative during both peak hours. The only significant increases in peak hour volumes (20 to 80 percent increases) will occur at the intersections of Dorchester Avenue with Summer and Congress Streets, because of a combination of both Third Harbor Tunnel (Summer Street ramp traffic) and still-high non-tunnel traffic destined to the northern development section at South Boston. The split alignment alternatives (2 and 3) result in substantially higher (up to 80 percent) peak hour volumes through these intersections, in most cases, than the two-way options (Alternatives 4 and 5).

In East Boston, peak hour traffic without the project will increase by 60 to 80 percent between 1982 and 2010 at the Airport Crossover Road intersection, because of future airport development. Without the project, significant increases will also occur at Porter Street/Chelsea Street/Visconti Road, Porter Street/Orleans Street, and Porter

Street/Cottage Street, with increases ranging from 25 to 80 percent in the AM peak hour and 30 to 45 percent in the PM peak hour. These increases will stem from Porter Street's continued use as the secondary access route to the airport.

With the Third Harbor Tunnel alternatives, decreases in AM peak hour traffic in 2010, some greater than 40 percent, will occur at the Sumner Street/Bremen Street intersection and at five select Porter Street intersections. During the PM peak, further decreases will occur at the Maverick Street/Bremen Street, Maverick Street/Jeffries Street/Airport Access Road, McClellan off-ramp/Neptune Road, and Condor Street/Meridian Street intersections. The effectiveness of the railroad alignment alternatives (2 and 4) versus the airport alignment alternatives in reducing peak hour traffic varies with intersection location, and the differences, except for the Airport Crossover Road intersection, are less than 10 percent. Because of the direct connections and ramp termini locations of the airport alignments (3 and 5) with respect to the airport, peak hour traffic at the Airport Crossover Road intersection is 35 to 40 percent less for these alternatives than for Alternatives 2 and 4.

Peak hour traffic at Bell Circle in Revere without the project will increase from 20 to 25 percent between 1982 and 2010. All four build alternatives will increase traffic at that intersection by 5 to 8 percent above the No-Build.

4.2.2 V/C Ratios and Levels of Service

Volume/capacity (v/c) ratios, operating speeds, and levels of service (LOS) for the five alternatives during the AM peak hour for 1982, 1990, and 2010 are summarized in Table 22 for the selected major highway link and ramp sections and local intersections. Comparable statistics are contained in Table 23 for the 1982, 1990, and 2010 PM peak hour.

Affected Highway Network

Highway Network as a Whole

The computed levels of service for the selected regional highway links and ramps have been tabulated into three classes for each alternative and for each time period, to offer an overview of total regional highway network impacts of the proposed project. They are summarized in Table 24. The three classes of level of service coincide wih the following:

(1) A-D: Acceptable operating conditions in an urban context.

(2) E: Unacceptable operating conditions, but tolerable, as traffic volumes are still equal to, or below capacity, and speeds are low but moving.

(3) F: Intolerable, forced-flow conditions, as traffic operations breakdown; stop-and-go traffic; demand volumes frequently in excess of capacities.

The measure of effectiveness of each alternative in the context of level of service is the degree to which it minimizes overall network LOS F operations (impacts) and achieves LOS A-D operations.

From Table 24, without the project (No-Build Alternative), the selected regional highway links and ramps will suffer increased LOS degradation between 1982 and 2010 during both peak hours, because of forecast increases in traffic. During the AM peak, locations with LOS F conditions will increase from 37 percent of total in 1982 to 56 percent of total in 2010. During the PM peak, locations with LOS F conditions will remain approximately the same, at 52 percent of total. LOS A-D locations will be reduced from 46 percent of

TABLE 22
A.M. PEAK HOUR VOLUME-TO-CAPACITY RATIO (V/C), OPERATING SPEED (SP) AND LEVEL OF SERVICE (LOS) 1990, 2010

		1982	1990					2010				
		EXISTING	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
		V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS	V/C SP LOS
MAJOR HIGHWAY LINKS - NORTHBOUND												
L1N.	S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	1.03 30 F	1.22 25 F	1.23 25 F	1.21 25 F	1.25 25 F	1.24 25 F	1.34 20 F	1.33 20 F	1.33 20 F	1.34 20 F	1.33 20 F
L2N.	Frontage Road: Adjacent to Mass. Ave. Interchange	0.69 30 D	0.74 25 D	0.66 35 C	0.67 35 C	0.69 30 D	0.70 30 D	0.76 25 D	0.74 25 D	0.77 25 D	0.79 25 D	0.74 25 D
L13N.	S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA	NA	1.11 30 F	1.10 30 F	1.12 30 F	1.10 30 F	NA	1.25 25 F	1.25 25 F	1.25 25 F	1.25 25 F
L14N.	S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA	NA	0.92 30 E	0.95 30 E	NA	NA	NA	1.04 25 F	1.08 25 F	NA	NA
L15N.	Central Artery: Btwn. Connector C-T and Dorchester Ave. Off-Ramp	NA	NA	1.08 30 F	1.06 30 F	NA	NA	NA	1.42 15 F	1.48 15 F	NA	NA
L16N.	Fort Point Channel Tunnel: Before Merge with Central Artery Roadway	NA	NA	0.60 45 B	0.65 45 B	NA	NA	NA	0.73 40 C	0.66 45 B	NA	NA
L17N.	Fort Point Channel Tunnel: Btwn. Central Artery Entrance and Exit Roadways	NA	NA	0.67 45 B	0.67 45 B	NA	NA	NA	0.81 40 D	0.81 40 D	NA	NA
L18N.	Central Artery Tunnel: After Third Harbor Tunnel Split	NA	NA	0.69 45 C	0.75 40 D	NA	NA	NA	0.87 40 D	0.92 35 E	NA	NA
L19N.	Third Harbor Tunnel	NA	NA	0.57 40 C	0.44 40 C	0.57 40 C	0.44 40 C	NA	0.62 40 C	0.48 40 C	0.62 40 C	0.48 40 C
L3N.	S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	1.10 30 F	1.10 30 F	NA	NA	NA	NA	1.31 20 F	NA	NA	NA	NA
L4N.	Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	1.13 20 F	1.29 15 F	NA	NA	1.00 20 F	1.01 20 F	1.62 10 F	NA	NA	1.37 10 F	1.38 10 F
L5N.	Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	0.96 30 F	1.06 25 F	0.86 35 E	0.94 30 E	0.82 35 E	0.87 35 E	1.19 20 F	1.06 25 F	1.14 20 F	0.97 30 F	1.02 30 F
L6N.	Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	0.90 35 E	1.06 25 F	0.96 30 E	0.98 30 E	0.94 30 F	0.94 30 F	1.24 20 F	1.27 15 F	1.28 15 F	1.19 20 F	1.17 20 F
L7N.	Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	0.89 25 F	0.68 40 C	0.59 40 C	0.59 40 C	0.64 40 C	0.64 40 C	0.91 30 E	0.88 30 E	0.89 30 E	0.91 30 E	0.89 30 E
L8N.	Mystic Tobin Bridge: North of I-93 Ramps	0.40 50 A	0.48 45 A	0.34 45 A	0.36 45 A	0.35 45 A	0.38 45 A	0.50 45 A	0.41 45 A	0.43 45 A	0.42 45 A	0.44 45 A
L9N.	I-93: North of Tobin Bridge Ramps	0.28 50 A	0.31 50 A	0.31 50 A	0.31 50 A	0.32 50 A	0.32 50 A	0.38 50 A	0.39 50 A	0.39 50 A	0.40 50 A	0.39 50 A
L10N.	Callahan Tunnel	0.85 35 D	0.99 30 E	0.51 35 C	0.62 35 C	0.51 35 C	0.62 35 C	1.17 20 F	0.65 35 C	0.80 35 D	0.65 35 C	0.80 35 D
L20N.	S.E. Expressway: Btwn. Frontage On - and Third Harbor Tunnel Off-Ramp	NA	NA	NA	NA	1.16 30 F	1.14 30 F	NA	NA	NA	1.30 25 F	1.30 25 F
L21N.	Fort Point Channel Tunnel: Btwn. Expwy./Frontage Merge and Tpk. On-Ramp	NA	NA	NA	NA	0.54 40 C	0.42 40 C	NA	NA	NA	0.55 40 C	0.42 40 C
L22N.	Fort Point Channel Tunnel: Btwn. Turnpike On - and Summer St. On-Ramps	NA	NA	NA	NA	0.42 40 C	0.34 40 C	NA	NA	NA	0.46 40 C	0.37 40 C
L11N.	Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	0.36 35 C	0.44 30 C	0.23 40 A	0.28 40 A	0.23 40 A	0.28 40 A	0.51 25 C	0.32 40 A	0.32 40 A	0.32 40 A	0.41 40 A
L23N.	Route 1A: Btwn. Third Harbor Tunnel On - and Airport On-Ramps	NA	NA	0.82 40 C	NA	0.82 40 C	NA	NA	0.76 40 C	NA	0.76 40 C	NA
L24N.	Airport Tunnel: Btwn. Off-Ramp to Airport and Off-Ramp to Route 1A	NA	NA	NA	0.13 35 C	NA	0.13 35 C	NA	NA	0.11 35 C	NA	0.11 35 C
L12N.	Route 1A: Btwn. Airport On - and Neptune Off-Ramps	0.17 45 A	0.22 45 A	0.25 45 A	0.28 45 A	0.25 45 A	0.28 45 A	0.24 45 A	0.26 45 A	0.30 45 A	0.26 45 A	0.30 45 A
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND												
L1E:	Mass. Turnpike, Eastbound; West of Expressway Ramps	0.80 40 D	0.87 30 E	0.83 30 E	0.82 30 E	0.91 30 E	0.91 30 E	0.88 30 E	0.82 30 E	0.81 30 E	0.92 30 E	0.92 30 E
L1W:	Mass. Turnpike, Westbound; West of Expressway Ramps	0.27 55 A	0.46 55 B	0.52 55 B	0.51 55 B	0.47 55 B	0.48 55 B	0.49 55 B	0.52 55 B	0.52 55 B	0.50 55 B	0.50 55 B
L2E:	Storrow Drive, Eastbound; West of Copley Square Ramps	0.59 40 C	0.59 40 C	0.57 40 C	0.59 40 C	0.59 40 C	0.59 40 C	0.69 40 C	0.70 40 C	0.71 40 C	0.68 40 C	0.67 40 C
L2W:	Storrow Drive, Westbound; West of Copley Square Ramps	0.42 40 C	0.57 40 C	0.50 40 C	0.50 40 C	0.54 40 C	0.53 40 C	0.67 40 C	0.66 40 C	0.67 40 C	0.66 40 C	0.66 40 C
MAJOR HIGHWAY LINKS - SOUTHBOUND												
L1S.	S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	0.62 50 B	0.71 40 D	0.74 40 D	0.74 40 D	0.73 40 D	0.73 40 D	0.78 40 D	0.79 40 D	0.79 40 D	0.79 40 D	0.79 40 D
L2S.	S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	0.62 50 A	0.64 40 D	0.65 35 E	0.65 35 E	0.64 40 D	0.64 40 D	0.70 30 F	0.71 30 F	0.71 30 F	0.70 30 F	0.70 30 F
L3S.	S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	0.73 35 D	0.60 45 B	0.59 40 C	0.59 40 C	0.57 50 A	0.57 50 A	0.63 40 C	0.61 35 D	0.60 35 D	0.59 50 A	0.59 50 A
L4S.	Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	0.74 40 C	0.78 25 F	NA	NA	NA	NA	0.85 25 F	NA	NA	NA	NA
L16S.	Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA	NA	0.76 45 C	0.76 45 C	0.59 45 C	0.59 45 C	NA	0.78 40 D	0.78 40 D	0.61 45 C	0.61 45 C
L17S.	Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA	NA	0.56 45 C	0.55 45 C	NA	NA	NA	0.57 45 C	0.57 45 C	NA	NA
L5S.	Central Artery: Btwn. Congress On - and Beach Off-Ramps	0.78 35 E	0.90 25 F	NA	NA	0.63 35 D	0.64 35 D	0.91 20 F	NA	NA	0.66 35 D	0.68 30 E
L18S.	Central Artery Local Rdwy: Btwn. Congress On - and Beach Off-Ramps	NA	NA	0.56 45 C	0.54 45 C	NA	NA	NA	0.60 40 C	0.59 40 C	NA	NA
L19S.	Third Harbor Tunnel	NA	NA	0.62 40 C	0.56 40 C	0.62 40 C	0.56 40 C	NA	0.64 40 C	0.59 40 C	0.64 40 C	0.59 40 C
L20S.	Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	0.18 40 C	0.19 40 C	NA	NA	NA	0.21 40 C	0.21 40 C	NA	NA
L21S.	Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	0.46 40 C	0.46 40 C	NA	NA	NA	0.47 40 C	0.47 40 C	NA	NA
L6S.	Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	0.83 30 E	0.92 25 F	NA	NA	0.67 40 C	0.68 40 C	0.97 20 F	NA	NA	0.72 35 D	0.72 35 D
L7S.	Central Artery: Btwn. Haymarket On - and High Off-Ramps	1.08 30 F	1.05 25 F	NA	NA	0.92 30 E	0.93 30 E	1.14 20 F	NA	NA	0.98 30 E	0.99 30 E
L22S.	Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA	NA	0.98 30 E	0.96 30 E	NA	NA	NA	1.00 25 F	1.01 25 F	NA	NA
L8S.	Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	0.96 30 F	0.95 25 F	0.82 25 F	0.84 25 F	0.82 25 F	0.83 25 F	1.03 20 F	1.01 20 F	1.03 20 F	0.97 20 F	0.97 20 F
L9S.	Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	0.96 30 E	0.96 25 E	0.90 30 E	0.90 30 E	0.90 30 E	0.91 30 E	1.14 20 F	1.13 20 F	1.15 20 F	1.12 20 F	1.12 20 F
L10S.	Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	1.20 20 F	0.88 25 F	0.73 25 F	0.74 25 F	0.80 25 F	0.80 25 F	1.14 20 F	1.06 20 F	1.10 20 F	1.10 20 F	1.10 20 F
L11S.	Mystic Tobin Bridge: North of I-93 Ramps	1.13 10 F	0.84 40 D	0.73 45 C	0.74 45 C	0.71 45 C	0.75 45 C	0.93 35 E	0.79 45 C	0.82 40 D	0.79 45 C	0.83 40 D
L12S.	I-93: North of Tobin Bridge Ramps	0.73 15 F	0.64 35 E	0.63 35 E	0.64 35 E	0.67 35 E	0.65 35 E	0.74 30 F	0.76 30 F	0.76 30 F	0.74 30 F	0.76 30 F
L13S.	Sumner Tunnel	1.17 20 F	1.28 20 F	0.79 35 C	0.81 35 D	0.79 35 C	0.81 35 D	1.37 20 F	0.93 30 E	0.94 30 E	0.93 30 E	0.94 30 E
L23S.	Fort Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA	NA	NA	NA	0.37 40 C	0.35 40 C	NA	NA	NA	0.40 40 C	0.37 40 C
L24S.	Fort Point Channel Tunnel: Btwn. Summer Off - and Mass. Tpk. Off-Ramps	NA	NA	NA	NA	0.37 40 C	0.36 40 C	NA	NA	NA	0.40 40 C	0.39 40 C
L14S.	Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	0.27 5 F	0.30 5 F	0.33 40 C	0.34 40 C	0.33 40 C	0.34 40 C	0.31 5 F	0.40 40 C	0.39 40 C	0.40 40 C	0.39 40 C
L25S.	Route 1A: Btwn. Airport/Third Harbor Off - and Airport On-Ramps	NA	NA	0.43 40 C	0.26 40 C	0.43 40 C	0.26 40 C	NA	0.43 40 C	0.26 40 C	0.44 40 C	0.26 40 C
L15S.	Route 1A: Btwn. Neptune On - and Airport Off-Ramps	0.31 45 A	0.26 45 A	NA	NA	NA	NA	0.26 45 A	NA	NA	NA	NA
L26S.	Airport Tunnel: Btwn. Porter On - and Airport On-Ramps	NA	NA	NA	0.35 40 C	NA	0.35 40 C	NA	NA	0.34 40 C	NA	0.34 40 C
L27S.	Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA	NA	NA	0.48 25 C	NA	0.48 25 C	NA	NA	0.64 25 C	NA	0.64 25 C
L28S.	Route 1A: Btwn. Neptune On-Ramp & Off-Ramp to Airport & Third Harbor Tunnel	NA	NA	0.54 40 C	0.43 30 E	0.54 40 C	0.43 30 E	NA	0.55 40 C	0.45 30 E	0.55 40 C	0.45 30 E
L29S.	Connector: Route 1A to Third Harbor Tunnel and Airport	NA	NA	0.60 40 C	0.55 40 C	0.60 40 C	0.55 40 C	NA	0.60 40 C	0.59 40 C	0.60 40 C	0.60 40 C
MAJOR HIGHWAY RAMPS - NORTHBOUND												
R1N.	Columbia Rd. Off; from S.E. Expressway	0.34 35 C	0.38 35 C	0.46 35 C	0.46 35 C	0.44 35 C	0.46 35 C	0.46 35 C	0.41 35 C	0.46 35 C	0.46 35 C	0.46 35 C
R2N.	Mass. Avenue On; to S.E. Expressway	0.30 35 D	0.99 30 F	0.87 30 F	0.89 30 F	0.97 30 F	0.84 30 F	1.31 30 F	1.29 30 F	1.33 30 F	1.21 30 F	1.18 30 F
R12N.	Ramp NA: S.E. Expressway to Fort Point Channel Tunnel	NA	NA	NA	NA	0.99 25 F	0.87 30 E	NA	NA	NA	0.44 35 B	0.42 35 B
R13N.	Ramp NS: Frontage Rd. to Fort Point Channel Tunnel	NA	NA	NA	NA	0.26 30 C	0.20 30 C	NA	NA	NA	0.31 30 C	0.23 30 C
R14N.	Dorchester Ave. Off; from Fort Point Channel Tunnel	NA	NA	1.33 10 F	1.35 10 F	0.54 35 B	0.52 35 B	NA	1.95 5 F	1.97 5 F	•	•
R15N.	Ramp ET: Mass. Tpk. to Fort Point Channel Tunnel	NA	NA	NA	NA	0.31 35 B	0.29 35 B	NA	NA	NA	0.40 35 B	0.33 35 B
R16N.	Summer St. On; to Third Harbor Tunnel	NA	NA	0.18 30 C	0.10 30 C	0.31 30 C	0.18 30 C	NA	0.18 30 C	0.20 30 C	0.31 30 C	0.18 30 C
R3N.	Mass. Tpk. On; to Central Artery	1.08 20 F	1.17 20 F	NA	NA	1.02 20 F	1.05 20 F	1.56 10 F	NA	NA	1.40 15 F	1.43 15 F
R4N.	Atlantic Ave. Off; from Central Artery	1.53 15 F	>2.00 10 F	NA	NA	>2.00 10 F	>2.00 10 F	>2.00 5 F	NA	NA	>2.00 5 F	>2.00 5 F
R5N.	Atlantic Ave. On; to Central Artery	0.16 25 F	0.61 25 F	0.76 25 F	0.84 25 F	0.41 30 D	0.48 25 F	0.59 20 F	0.90 20 F	0.98 20 F	0.42 20 F	0.48 20 F
R6N.	Callahan Tunnel Off; from Central Artery	0.86 25 F	0.81 25 E	0.17 30 C	0.39 30 C	0.10 30 C	0.31 30 C	0.86 20 F	0.12 30 C	0.37 30 C	0.07 30 C	0.31 30 C
R7N.	Sumner Tunnel On; to Central Artery	0.91 30 E	1.00 15 F	0.86 20 E	0.88 20 E	0.93 15 F	0.93 15 F	1.37 10 F	1.40 10 F	1.44 5 F	1.42 5 F	1.42 5 F
R8N.	Storrow Drive Off; from Central Artery	0.62 35 C	0.59 35 C	0.53 35 C	0.56 35 C	0.56 35 C	0.56 35 C	0.80 25 E	0.83 25 E	0.86 25 E	0.82 25 E	0.80 25 E
R9N.	Storrow Drive On; to Central Artery	0.75 30 E	•	0.42 30 C	0.42 30 C	0.47 30 C	0.47 30 C	•	0.62 30 C	0.62 30 C	0.67 25 D	0.67 25 D
R17N.	Connector C-T: Central Artery to Mass. Tpk./Kneeland St.	NA	NA	0.91 25 E	0.92 25 E	NA	NA	NA	0.69 30 D	0.58 35 C	NA	NA
R18N.	Ramp S-C: Frontage Rd. to Fort Point Channel	NA	NA	0.88 30 E	1.03 25 F	NA	NA	NA	1.10 25 F	0.95 30 E	NA	NA

TABLE 22 (CONTINUED)
A.M. PEAK HOUR VOLUME-TO-CAPACITY RATIO (V/C), OPERATING SPEED (SP), & LEVELS OF SERVICE (LOS) 1990, 2010

		1982 EXISTING			1990 ALT. 1			1990 ALT. 2			1990 ALT. 3			1990 ALT. 4			1990 ALT. 5			2010 ALT. 1			2010 ALT. 2			2010 ALT. 3			2010 ALT. 4			2010 ALT. 5		
		V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS	V/C	SP	LOS
MAJOR HIGHWAY RAMPS - NORTHBOUND (Continued)																																		
R19N.	Connector T-C: Mass. Tpk. to Fort Point Channel Tunnel	NA			NA			0.20	45	B	0.20	45	B	NA			NA			NA			0.24	45	B	0.24	45	B	NA			NA		
R10N.	Airport Off; from Route 1A	0.87	30	E	1.07	25	F	0.59	30	C	0.59	30	C	0.59	30	C	0.59	30	C	1.33	20	F	0.85	25	E	1.00	25	F	0.86	25	E	1.00	25	F
R11N.	Airport On; to Route 1A	0.17	40	B	0.28	40	B	0.31	40	A	NA			0.31	40	A	NA			0.36	40	B	0.40	40	B	NA			0.40	40	B	NA		
R20N.	Ramp AP-1: Third Harbor Tunnel to Airport	NA			NA			0.62	30	C	0.67	30	C	0.62	30	C	0.67	30	C	NA			0.84	25	E	0.82	25	E	0.84	25	E	0.82	25	E
R21N.	Ramp 1A-1: Third Harbor Tunnel to Route 1A	NA			NA			0.33	40	B	0.31	35	C	0.33	40	B	0.31	35	C	NA			0.27	40	B	0.25	35	C	0.27	40	B	0.25	35	C
R22N.	Airport/Third Harbor Tunnel On: to Route 1A	NA			NA			NA			0.37	35	B	NA			0.37	35	B	NA			NA			0.40	30	C	NA			0.40	30	C
MAJOR HIGHWAY RAMPS - SOUTHBOUND																																		
R1S.	Columbia Rd. On; to S.E. Expressway	0.27	35	C	•			•			•			•			•			•			•			•			•			•		
R2S.	Mass. Ave. Off; from S.E. Expressway	0.23	40	B	•			•			•			•			•			•			•			•			•			•		
R3S.	Albany St. On; to S.E. Expressway	0.40	30	C	0.33	30	C	0.28	30	C	0.28	30	C	0.28	30	C	0.28	30	C	0.33	30	C	0.28	30	C	0.25	30	C	0.28	30	C	0.28	30	C
R13S.	Ramp SA: Fort Point Channel Tunnel to S.E. Expressway	NA			NA			NA			NA			0.42	30	C	0.42	30	C	NA			NA			NA			0.46	30	C	0.42	30	C
R14S.	Ramp SS: Fort Point Channel Tunnel to Albany St.	NA			NA			NA			NA			0.31	30	C	0.30	30	C	NA			NA			NA			0.34	30	C	0.30	30	C
R15S.	Ramp WT: Fort Point Channel Tunnel to Mass. Tpk.	NA			NA			NA			NA			0.12	30	C	0.14	30	C	NA			NA			NA			0.14	30	C	0.14	30	C
R16S.	Summer St. Off; from Fort Point Channel Tunnel	NA			NA			NA			NA			0.49	30	C	0.37	30	C	NA			NA			NA			0.46	30	C	0.37	30	C
R4S.	Mass. Tpk./Albany St. Off; from Central Artery	0.85	25	E	•			1.00	25	E	1.03	20	F	0.77	25	E	0.80	25	E	•			1.26	20	F	1.29	20	F	0.93	25	E	0.93	25	E
R17S.	Ramp A: Mass. Tpk./Kneeland St. to Central Artery	NA			NA			0.92	25	E	0.92	25	E	NA			NA			NA			0.95	25	E	0.92	25	E	NA			NA		
R5S.	Dewey Sq. Off; from Central Artery	0.50	30	C	0.49	30	C	0.36	30	C	0.33	30	C	0.41	30	C	0.41	30	C	0.56	30	C	0.33	30	C	0.28	30	C	0.48	30	C	0.41	30	C
R6S.	High St. Off; from Central Artery	0.87	20	E	0.74	20	E	NA			NA			0.69	20	D	0.69	20	D	0.89	20	E	NA			NA			0.69	20	D	0.69	20	D
R18S.	Congress St. On; to Central Artery	NA			NA			0.56	30	C	0.56	30	C	NA			NA			NA			0.61	30	C	0.64	30	C	NA			NA		
R19S.	Ramp C-P: Central Artery to Purchase St.	NA			NA			1.12	15	F	0.99	20	E	NA			NA			NA			1.05	15	F	1.07	15	F	NA			NA		
R7S.	Haymarket On; to Central Artery	1.01	15	F	1.13	15	F	0.90	20	E	0.79	20	E	0.64	20	E	0.64	20	E	1.32	10	F	0.73	20	E	0.71	20	E	0.64	20	E	0.64	20	E
R8S.	Callahan Tunnel Off; from Central Artery	0.41	15	F	0.49	15	F	0.51	15	F	0.51	15	F	0.45	15	F	0.45	15	F	0.62	15	F	0.76	10	F	0.76	10	F	0.62	10	F	0.62	10	F
R9S.	Storrow Drive On; to Central Artery	0.98	20	F	1.34	20	F	1.48	20	F	1.48	20	F	1.31	20	F	1.36	20	F	1.39	20	F	1.51	20	F	1.51	20	F	1.41	20	F	1.36	20	F
R10S.	Storrow Drive Off; from Central Artery	1.12	20	F	1.06	20	F	0.91	25	E	0.94	25	E	1.01	20	F	1.01	20	F	1.39	20	F	1.31	20	F	1.36	20	F	1.39	20	F	1.01	20	F
R11S.	Airport Off; from Route 1A	0.47	35	B	0.54	30	C	0.51	30	C	0.53	30	C	0.51	30	C	0.53	30	C	0.63	30	C	0.58	30	C	0.63	30	C	0.58	30	C	0.63	30	C
R12S.	Airport On; to Route 1A	0.34	30	C	0.69	30	C	0.61	30	C	0.56	30	C	0.61	30	C	0.56	30	C	0.87	25	E	0.86	25	E	0.79	25	E	0.86	25	E	0.79	25	E
R20S.	Ramp 1A-2: Route 1A to Third Harbor Tunnel	NA			NA			0.92	25	E	0.73	30	D	0.92	25	E	0.73	30	D	NA			0.92	25	E	0.73	30	D	0.92	25	E	0.73	30	D
R21S.	Ramp AP-2: Airport to Third Harbor Tunnel	NA			NA			NA			0.40	30	D	NA			0.40	30	D	NA			NA			0.50	30	D	NA			0.50	30	D
R22S.	Ramp AP-3: Airport to Third Harbor Tunnel	NA			NA			0.42	30	C	NA			0.42	30	C	NA			NA			0.53	30	C	NA			0.53	30	C	NA		

INTERSECTIONS

		1982 EXISTING V/C	LOS	1990 ALT. 1 V/C	LOS	1990 ALT. 2 V/C	LOS	1990 ALT. 3 V/C	LOS	1990 ALT. 4 V/C	LOS	1990 ALT. 5 V/C	LOS	2010 ALT. 1 V/C	LOS	2010 ALT. 2 V/C	LOS	2010 ALT. 3 V/C	LOS	2010 ALT. 4 V/C	LOS	2010 ALT. 5 V/C	LOS
South Boston																							
1.	Columbia Circle	0.85	D	0.95	E	0.94	E	0.94	E	0.95	E	0.95	E	0.95	E	0.95	E	0.95	E	0.94	E	0.94	E
2.	Andrew Square**	1.02	F	1.63	F	1.51	F	1.51	F	1.53	F	1.53	F	1.65	F	1.63	F	1.63	F	1.66	F	1.66	F
3.	Columbia Rd./Day Blvd./L St.	0.25	C	>2.00	F	>2.00	F	>2.00	F	1.41	F	1.41	F	>2.00	F	1.87	F	1.87	F	>2.00	F	>2.00	F
4.	L St./East First St./Summer St.**	0.86	D	0.92	E	0.88	D	0.88	D	0.83	D	0.83	D	0.93	E	0.95	E	0.95	E	0.88	D	0.88	D
5.	Dorchester Ave./W. 5th St./A St.**	0.53	A	0.55	A	0.46	A	0.46	A	0.55	A	0.55	A	0.56	A	0.56	A	0.56	A	0.61	B	0.61	B
6.	Dorchester Ave./W. 4th St.**	0.58	A	0.50	A	0.42	A	0.42	A	0.46	A	0.46	A	0.52	A	0.49	A	0.49	A	0.50	A	0.50	A
7.	Dorchester Ave./W. Broadway**	0.87	D	0.92	E	0.80	D	0.80	D	0.81	D	0.81	D	0.96	E	0.86	D	0.86	D	0.86	D	0.86	D
8.	Summer St./Dorchester Ave.**	0.78	C	0.99	E	1.81	F	1.81	F	1.39	F	1.39	F	0.99	E	>2.00	F	>2.00	F	1.44	F	1.44	F
9.	Summer St./Melcher St.**	0.44	A	0.53	A	0.54	A	0.54	A	0.56	A	0.56	A	0.53	A	0.57	A	0.57	A	0.54	A	0.54	A
10.	Summer St./D St.**	0.73	C	0.78	C	0.59	A	0.59	A	0.60	B	0.60	B	0.60	B	0.61	B	0.61	B	0.59	A	0.59	A
11.	Congress St./Dorchester Ave.	>2.00	F	>2.00	F	1.42	F	1.42	F	0.95	E	0.95	E	•		1.77	F	1.77	F	1.00	E	1.00	E
12.	Congress St./A St.	0.88	E	1.47	F	>2.00	F	>2.00	F	1.42	F	1.42	F	1.47	F	>2.00	F	>2.00	F	1.47	F	1.47	F
13.	Northern Ave./Sleeper St.	1.30	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	1.91	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F
14.	Herald St./Broadway/Frontage Rd./Albany St.**	0.84	D	1.07	F	0.73	C	0.73	C	0.83	D	0.83	D	1.13	F	0.79	C	0.79	C	0.86	D	0.86	D
15.	Berkeley St./W. Fourth St./Frontage Rd.**	1.03	F	1.07	F	0.93	E	0.93	E	1.00	E	1.00	E	1.11	F	0.98	E	0.98	E	1.06	F	1.06	F
East Boston and Revere																							
16.	Sumner St./Meridian St./Chelsea St.**	0.26	A	0.44	A	0.44	A	0.31	A	0.44	A	0.31	A	0.44	A	0.44	A	0.36	A	0.44	A	0.36	A
17.	Sumner St./Bremen St.	0.08	B	0.22	B	0.14	B	0.20	B	0.14	B	0.20	B	0.14	B	0.27	A	0.15	A	0.27	A	0.15	A
18.	Maverick St./Meridian St./Chelsea St.	0.52	C	0.52	C	0.51	C	0.69	D	0.51	C	0.69	D	0.51	C	0.55	C	0.51	C	0.55	C	0.51	C
19.	Maverick St./Bremen St.	0.21	A	0.20	A	0.20	A	0.13	B	0.20	A	0.13	B	0.20	A	0.13	B	0.21	A	0.13	B	0.21	A
20.	Maverick St./Jeffries St./Airport Access Rd.	0.26	A	0.26	A	0.26	A	0.19	A	0.26	A	0.19	A	0.26	A	0.26	A	0.26	A	0.26	A	0.26	A
21.	Porter St./Chelsea St./Visconti Rd.**	0.83	D	0.93	E	0.42	A	0.66	B	0.42	A	0.66	B	1.27	F	0.66	B	0.59	A	0.66	B	0.59	A
22.	Porter St./Bremen St.	0.52	D	0.94	E	0.50	C	0.79	E	0.50	C	0.79	E	1.09	F	0.77	E	0.87	E	0.77	E	0.87	E
23.	Porter St./Orleans St.	0.11	A	0.27	D	0.10	A	0.16	A	0.10	A	0.16	A	0.27	D	0.11	B	0.10	A	0.11	B	0.10	A
24.	Porter St./Cottage St.	0.34	A	0.49	A	0.34	A	0.34	A	0.34	A	0.34	A	0.64	B	0.48	A	0.47	A	0.48	A	0.47	A
25.	Central Square (Meridian St./Saratoga St.)**	0.42	A	0.46	A	0.58	A	0.46	A	0.58	A	0.46	A	0.57	A	0.56	A	0.66	B	0.56	A	0.66	B
26.	Porter St./London St.	1.05	F	1.22	F	0.54	D	0.50	C	0.54	D	0.50	C	1.30	F	0.90	D	0.73	D	0.90	D	0.73	D
27.	Bennington St./Prescott St.	0.23	D	NO DATA AVAILABLE																			
28.	Chelsea St./East Eagle St.	0.18	C	0.22	D	0.26	D	0.27	D	0.26	D	0.27	D	0.28	D	0.24	C	0.33	D	0.24	C	0.33	D
29.	Bennington St./Neptune Rd.	0.68	B	NO DATA AVAILABLE																			
30.	McClellan Off-Ramp/Neptune Rd.	0.55	C	0.38	C	1.11	F	0.83	E	1.11	F	0.83	E	0.56	D	0.93	E	0.83	E	0.93	E	0.83	E
31.	Condor St./Meridian St.**	0.42	A	0.41	A	0.57	A	0.30	A	0.57	A	0.30	A	0.65	B	0.54	A	0.69	B	0.54	A	0.69	B
32.	Airport Crossover Roads**	0.64	B	0.77	C	0.91	E	0.57	A	0.91	E	0.57	A	0.94	E	1.19	F	0.80	D	1.19	F	0.80	D
33.	Bell Circle (Revere)**	1.15	F	1.33	F	1.44	F	1.09	F	1.44	F	1.09	F	1.37	F	1.17	F	1.05	F	1.17	F	1.05	F
Downtown																							
34.	Kneeland St./Surface Artery/S.B. On-Ramp**	0.69	B	1.04	F	0.72	C	0.74	C	0.83	D	0.85	D	0.97	E	0.58	A	0.67	B	0.83	D	0.84	D
35.	Dewey Square**	0.57	F	•		1.81	F	1.71	F	1.55	F	1.59	F	1.73	F	1.34	F	1.56	F	1.37	F	1.35	F
36.	Atlantic Ave./Congress St.**	0.94	E	•		1.32	F	1.49	F	1.41	F	1.35	F	1.36	F	1.34	F	1.33	F	1.11	F	1.12	F
37.	Atlantic Ave./Northern Ave.	>2.00	F	•		1.48	F	1.51	F	1.07	F	1.06	F	>2.00	F	1.63	F	1.66	F	1.20	F	1.20	F
38.	Atlantic Ave./Surface Artery/High St.**	0.89	D	1.42	F	1.25	F	1.15	F	1.28	F	1.29	F	1.42	F	1.51	F	1.51	F	1.28	F	1.29	F
39.	Purchase St./Congress St.**	0.65	B	0.64	B	1.00	E	1.01	F	0.58	A	0.60	B	0.68	B	1.06	F	1.07	F	0.57	A	0.59	A
40.	North St./Blackstone St./S.B. Off-Ramp	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F	>2.00	F
41.	Cross St./Hanover St./Salem St.	1.89	F	>2.00	F	1.61	F	1.65	F	1.61	F	1.75	F	>2.00	F	1.22	F	1.16	F	1.32	F	1.53	F
42.	Leverett Circle**	0.96	E	1.09	F	1.13	F	1.21	F	1.05	F	1.08	F	0.99	E	1.05	F	1.05	F	0.97	E	1.00	E
43.	Dorchester Ave./Northern Ave. (Assumed **)	NA		NA		0.70	C	0.70	C	0.70	C	0.70	C	NA		0.96	E	0.96	E	0.81	D	0.81	D
44.	Summer St./Fort Point Channel Tunnel Ramps (Assumed **)	NA		NA		NA		NA		0.68	B	0.68	B	NA		NA		NA		0.73	B	0.73	B

NA - Not Applicable for this Alternative

* - Inconsistent Data
** - Signalized Intersection

NOTE: V/C ratios and levels of service, at unsignalized intersections, indicate minor street operating conditions.

TABLE 23
P.M. PEAK HOUR VOLUME-TO-CAPACITY RATIO (V/C), OPERATING SPEED (SP) AND LEVEL OF SERVICE (LOS)
1990, 2010

	1982 EXISTING V/C SP LOS	1990 ALT. 1 V/C SP LOS	1990 ALT. 2 V/C SP LOS	1990 ALT. 3 V/C SP LOS	1990 ALT. 4 V/C SP LOS	1990 ALT. 5 V/C SP LOS	2010 ALT. 1 V/C SP LOS	2010 ALT. 2 V/C SP LOS	2010 ALT. 3 V/C SP LOS	2010 ALT. 4 V/C SP LOS	2010 ALT. 5 V/C SP LOS
MAJOR HIGHWAY LINKS - NORTHBOUND											
L1N. S.E. Expressway: Btwn. Columbia On - and Southampton Off-Ramps	0.60 40 C	0.83 35 E	0.85 35 E	0.85 35 E	0.85 35 E	0.85 35 E	0.91 35 E	0.92 35 E	0.92 35 E	0.92 35 E	0.92 35 E
L2N. Frontage Road: Adjacent to Mass. Ave. Interchange	0.46 40 B	0.44 40 B	0.37 40 B	0.37 40 B	0.40 40 B	0.40 40 B	0.42 40 B	0.45 40 B	0.43 40 B	0.45 40 B	0.45 40 B
L13N. S.E. Expressway: Btwn. Mass. Ave. On - and Frontage On-Ramps	NA	NA	0.79 40 D	0.79 40 D	0.75 40 D	0.75 40 D	NA	0.85 35 E	0.85 35 E	0.80 40 D	0.80 40 D
L14S. S.E. Expressway: Btwn. Frontage On - and Connector C-T	NA	NA	0.68 40 D	0.68 40 D	NA	NA	NA	0.71 40 D	0.71 40 D	NA	NA
L15N. Central Artery: Btwn. Connector C-T and Dorchester Ave. Off-Ramp	NA	NA	0.81 40 D	0.83 40 D	NA	NA	NA	0.89 40 D	0.88 40 D	NA	NA
L16N. Fort Point Channel Tunnel: Before Merge with Central Artery Roadway	NA	NA	0.58 45 B	0.57 45 B	NA	NA	NA	0.62 45 B	0.63 45 B	NA	NA
L17N. Fort Point Channel Tunnel: Btwn. Central Artery Entrance and Exit Roadways	NA	NA	0.67 45 B	0.67 45 B	NA	NA	NA	0.70 45 B	0.70 45 B	NA	NA
L18N. Central Artery Tunnel: After Third Harbor Tunnel Split	NA	NA	0.70 40 C	0.68 40 C	NA	NA	NA	0.68 40 C	0.68 40 C	NA	NA
L19N. Third Harbor Tunnel	NA	NA	0.77 35 D	0.67 40 C	0.77 35 D	0.67 40 C	NA	0.84 35 D	0.77 35 D	0.84 35 D	0.77 35 D
L3N. S.E. Expressway: Btwn. E. Berkeley On - and Mass. Tpk. Off-Ramps	0.75 30 F	0.81 30 F	NA	NA	NA	NA	0.88 25 F	NA	NA	NA	NA
L4N. Central Artery: Btwn. South St. On - and Northern Ave. Off-Ramps	0.75 15 F	1.01 15 F	NA	NA	0.68 30 F	0.70 30 F	1.00 15 F	NA	NA	0.72 25 F	0.73 25 F
L5N. Central Artery: Btwn. Atlantic On - and Callahan Off-Ramps	0.78 15 F	1.06 15 F	0.92 25 F	0.98 25 F	0.92 25 F	0.93 25 F	1.11 15 F	1.00 25 F	0.99 25 F	0.85 25 F	0.96 25 F
L6N. Central Artery: Btwn. Sumner On - and Causeway Off-Ramps	0.79 15 F	0.99 15 F	1.02 20 F	0.99 20 F	1.00 20 F	0.95 20 F	1.00 15 F	1.09 15 F	1.05 15 F	0.97 20 F	0.99 20 F
L7N. Central Artery: Btwn. Storrow On - and Tobin Off-Ramps	1.30 15 F	*	0.81 35 D	0.87 30 E	0.80 35 D	0.87 30 E	*	1.00 30 E	1.04 20 F	0.95 30 E	0.92 30 E
L8N. Mystic Tobin Bridge: North of I-93 Ramps	0.78 45 C	0.85 40 D	0.71 45 C	0.73 45 C	0.70 45 C	0.73 45 C	0.90 35 E	0.77 45 C	0.81 40 D	0.77 45 C	0.77 45 C
L9N. I-93: North of Tobin Bridge Ramps	0.59 50 C	0.59 50 C	0.62 50 C	0.58 50 C	0.59 50 C	0.58 50 C	0.61 50 C	0.65 50 C	0.66 50 C	0.65 50 C	0.57 50 C
L10N. Callahan Tunnel	1.06 20 F	1.39 20 F	0.73 35 C	0.82 35 D	0.73 35 C	0.82 35 D	1.51 15 F	0.86 35 D	0.93 30 E	0.86 35 D	0.93 35 E
L20N. S.E. Expressway: Btwn. Frontage On - and Third Harbor Tunnel Off-Ramp	NA	NA	NA	NA	0.76 40 C	0.75 40 C	NA	NA	NA	0.81 35 D	0.82 35 D
L21N. Fort Point Channel Tunnel: Btwn. Expwy./Frontage Merge and Tpk. On-Ramp	NA	NA	NA	NA	0.61 40 C	0.57 45 B	NA	NA	NA	0.73 40 C	0.71 40 C
L22N. Fort Point Channel Tunnel: Btwn. Turnpike On - and Summer St. On-Ramps	NA	NA	NA	NA	0.43 35 D	0.42 40 C	NA	NA	NA	0.51 30 E	0.51 35 D
L11N. Route 1A: Btwn. Callahan Toll Plaza and Airport Off-Ramp	0.45 30 C	0.58 20 C	0.33 40 C	0.39 35 C	0.33 40 C	0.39 35 C	0.63 20 C	0.37 35 C	0.37 35 C	0.37 35 C	0.44 30 C
L23N. Route 1A: Btwn. Third Harbor Tunnel On - and Airport On-Ramps	NA	NA	0.22 40 C	NA	0.22 40 C	NA	NA	0.40 40 C	NA	0.40 40 C	NA
L24N. Airport Tunnel: Btwn. Off-Ramp to Airport and Off-Ramp to Route 1A	NA	NA	NA	0.30 30 C	NA	0.30 30 C	NA	NA	0.31 30 C	NA	0.31 30 C
L12N. Route 1A: Btwn. Airport On - and Neptune Off-Ramps	0.39 45 A	0.43 40 B	0.47 35 C	0.58 35 C	0.47 35 C	0.58 35 C	0.47 40 B	0.48 35 C	0.60 35 C	0.48 35 C	0.63 35 C
MAJOR HIGHWAY LINKS - EASTBOUND AND WESTBOUND											
L1E: Mass. Turnpike, Eastbound: West of Expressway Ramps	0.37 45 C	0.45 45 C	0.47 45 C	0.48 45 C	0.49 45 C	0.49 45 C	0.52 45 C	0.51 45 C	0.52 45 C	0.52 45 C	0.54 45 C
L1W: Mass. Turnpike, Westbound; West of Expressway Ramps	0.58 55 B	0.62 55 B	0.71 45 C	0.70 45 C	0.67 45 C	0.66 45 C	0.66 50 C	0.76 45 C	0.75 45 C	0.70 45 C	0.72 45 C
L2E: Storrow Drive, Eastbound; West of Copley Square Ramps	0.45 40 C	0.51 40 C	0.50 40 C	0.50 40 C	0.51 40 C	0.50 40 C	0.53 40 C	0.53 40 C	0.51 40 C	0.52 40 C	0.53 40 C
L2W: Storrow Drive, Westbound; West of Copley Square Ramps	0.59 40 C	0.68 40 C	0.65 40 C	0.65 40 C	0.65 40 C	0.67 40 C	0.69 40 C	0.75 35 D	0.73 35 D	0.72 35 D	0.71 35 D
MAJOR HIGHWAY LINKS - SOUTHBOUND											
L1S. S.E. Expressway: Btwn. Southampton On - and Columbia Off-Ramps	0.74 30 F	1.15 30 F	1.19 30 F	1.19 30 F	1.18 30 F	1.18 30 F	1.22 30 F	1.26 30 F	1.26 30 F	1.24 30 F	1.24 30 F
L2S. S.E. Expressway: Btwn. Mass. Ave. On - and Southampton Off-Ramps	0.85 30 E	1.21 25 F	1.07 25 F	1.07 25 F	1.08 25 F	1.08 25 F	1.35 20 F	1.14 20 F	1.14 20 F	1.13 20 F	1.13 20 F
L3S. S.E. Expressway: Btwn. Albany On - and Mass. Ave. Off-Ramps	0.95 20 F	1.13 20 F	1.02 20 F	1.02 20 F	1.05 20 F	1.05 20 F	1.17 20 F	1.07 20 F	1.07 20 F	1.09 20 F	1.09 20 F
L4S. Central Artery: Btwn. Kneeland On - and Albany Off-Ramps	0.72 20 F	1.13 20 F	NA	NA	NA	NA	1.16 20 F	NA	NA	NA	NA
L16S. Central Artery: South of Kneeland St./Mass. Tpk. On-Ramp	NA	NA	1.19 30 F	1.16 30 F	0.93 35 E	0.93 35 E	NA	1.21 30 F	1.19 30 F	0.95 35 E	0.98 35 E
L17S. Central Artery: South of Thru Rdwy./Local Rdwy. Merge	NA	NA	0.83 30 F	0.81 30 F	NA	NA	NA	0.85 30 F	0.84 30 F	NA	NA
L5S. Central Artery: Btwn. Congress On - and Beach Off-Ramps	0.75 20 F	1.10 15 F	NA	NA	0.85 20 F	0.85 20 F	1.12 15 F	NA	NA	0.87 20 F	0.87 20 F
L18S. Central Artery Local Rdwy: Btwn. Congress On - and Beach Off-Ramps	NA	NA	0.66 40 C	0.65 40 C	NA	NA	NA	0.70 40 C	0.71 40 C	NA	NA
L19S. Third Harbor Tunnel	NA	NA	0.63 40 C	0.56 40 C	0.60 40 C	0.56 40 C	NA	0.70 40 C	0.69 40 C	0.70 40 C	0.69 40 C
L20S. Central Artery Local Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	0.09 40 C	0.07 40 C	NA	NA	NA	0.09 40 C	0.08 40 C	NA	NA
L21S. Central Artery Thru Rdwy: South of Thru Rdwy./Local Rdwy. Split	NA	NA	0.66 40 C	0.66 40 C	NA	NA	NA	0.68 40 C	0.68 40 C	NA	NA
L6S. Central Artery: Btwn. Purchase On - and Dewey Square Off-Ramps	0.65 25 F	1.02 20 F	NA	NA	0.75 30 F	0.75 30 F	1.05 20 F	NA	NA	0.77 30 F	0.77 30 F
L7S. Central Artery: Btwn. Haymarket On - and High Off-Ramps	0.64 25 F	0.94 25 F	NA	NA	0.81 30 F	0.85 30 F	0.98 25 F	NA	NA	0.86 30 F	0.86 30 F
L22S. Central Artery: Btwn. Haymarket On - and Purchase Off-Ramps	NA	NA	0.94 30 F	0 94 30 F	NA	NA	NA	0.99 30 F	0.97 30 F	NA	NA
L8S. Central Artery: Btwn. Causeway On - and Callahan Off-Ramps	0.62 25 F	0.91 25 F	0.67 30 F	0.73 30 F	0.69 30 F	0.73 30 F	0.94 25 F	0.82 30 F	0.83 30 F	0.82 30 F	0.73 30 F
L9S. Central Artery: Btwn. Storrow On - and Haymarket Off-Ramps	0.51 25 F	0.77 25 F	0.71 30 F	0.76 30 F	0.72 30 F	0.75 30 F	0.77 25 F	0.84 30 F	0.87 30 F	0.82 30 F	0.82 30 F
L10S. Central Artery: Btwn. Tobin On - and Storrow Off-Ramps	0.81 25 F	0.74 25 F	0.68 30 F	0.71 30 F	0.66 30 F	0.73 30 F	0.75 30 F	0.86 30 F	0.89 30 F	0.85 30 F	0.80 30 F
L11S. Mystic Tobin Bridge: North of I-93 Ramps	0.81 30 F	0.56 45 C	0.41 45 C	0.45 45 C	0.39 45 C	0.45 45 C	0.62 45 C	0.45 45 C	0.49 45 C	0.43 45 C	0.46 45 C
L12S. I-93: North of Tobin Bridge Ramps	0.40 50 C	0.53 50 C	0.53 50 C	0.53 50 C	0.53 50 C	0.53 50 C	0.55 50 C	0.62 40 D	0.63 40 D	0.61 50 C	0.59 50 C
L13S. Sumner Tunnel	0.98 20 F	1.04 20 F	0.59 35 C	0.55 35 C	0.59 35 C	0.55 35 C	1.21 20 F	0.73 35 C	0.67 35 C	0.73 35 C	0.67 35 C
L23S. Fort Point Channel Tunnel: Btwn. Mass. Tpk. Off - and Albany Off-Ramps	NA	NA	NA	NA	0.37 40 C	0.34 40 C	NA	NA	NA	0.41 40 C	0.40 40 C
L24S. Fort Point Channel Tunnel: Btwn. Summer Off - and Mass. Tpk. Off-Ramps	NA	NA	NA	NA	0.41 40 C	0.38 40 C	NA	NA	NA	0.47 40 C	0.47 40 C
L14S. Route 1A: Btwn. Airport On-Ramp and Sumner Toll Plaza	0.34 5 F	0.31 5 F	0.27 40 C	0.25 40 C	0.27 40 C	0.25 40 C	0.36 5 F	0.33 40 C	0.31 40 C	0.33 40 C	0.31 40 C
L25S. Route 1A: Btwn. Airport/Third Harbor Off - and Airport On-Ramps	NA	NA	0.16 40 C	0.10 40 C	0.16 40 C	0.10 40 C	NA	0.17 40 C	0.10 40 C	0.17 40 C	0.10 40 C
L15S. Route 1A: Btwn. Neptune On - and Airport Off-Ramps	0.28 45 A	0.18 45 A	NA	NA	NA	NA	0.20 45 A	NA	NA	NA	NA
L26S. Airport Tunnel: Btwn. Porter On - and Airport On-Ramps	NA	NA	NA	0.24 40 C	NA	0.26 40 C	NA	NA	0.25 40 C	NA	0.25 40 C
L27S. Airport Access Rdwy: Btwn. Third Harbor On-Ramp and Parking Garage	NA	NA	NA	0.46 25 C	NA	0.46 25 C	NA	NA	0.61 20 D	NA	0.61 20 D
L28S. Route 1A: Btwn. Neptune On-Ramp & Off-Ramp to Airport & Third Harbor Tunnel	NA	NA	0.34 40 C	0.22 35 D	0.34 40 C	0.22 35 D	NA	0.37 40 C	0.27 35 D	0.37 40 C	0.27 35 D
L29S. Connector: Route 1A to Third Harbor Tunnel and Airport	NA	NA	0.44 40 C	0.37 40 C	0.44 40 C	0.37 40 C	NA	0.48 40 C	0.42 40 C	0.48 40 C	0.42 40 C
MAJOR HIGHWAY RAMPS - NORTHBOUND											
R1N. Columbia Rd. Off: from S.E. Expressway	0.17 35 C	*	*	*	*	*	0.22 35 C	0.13 35 C	0.13 35 C	0.13 35 C	0.13 35 C
R2N. Mass. Avenue On: to S.E. Expressway	0.13 40 B	0.46 35 D	0.55 35 D	0.55 35 D	0.41 35 D	0.41 35 D	0.46 35 D	0.72 30 F	0.72 30 F	0.48 35 D	0.48 35 D
R12N. Ramp NA: S.E. Expressway to Fort Point Channel Tunnel	NA	NA	NA	NA	0.53 35 B	0.53 35 B	NA	NA	NA	0.62 30 C	0.62 30 C
R13N. Ramp NS: Frontage Rd. to Fort Point Channel Tunnel	NA	NA	NA	NA	0.26 30 C	0.23 30 C	NA	NA	NA	0.33 30 C	0.28 30 C
R14N. Dorchester Ave. Off: from Fort Point Channel Tunnel	NA	NA	0.59 30 C	0.59 30 C	*	*	NA	0.62 30 C	0.62 30 C	*	*
R15N. Ramp ET: Mass. Tpk. to Fort Point Channel Tunnel	NA	NA	NA	NA	0.25 35 B	0.25 35 B	NA	NA	NA	0.32 35 B	0.32 35 B
R16N. Summer St. On: to Third Harbor Tunnel	NA	NA	0.74 25 D	0.51 30 C	0.74 25 D	0.54 30 C	NA	0.72 20 E	0.54 25 D	0.72 20 E	0.54 25 D
R3N. Mass. Tpk. On: to Central Artery	0.51 30 C	0.51 30 C	NA	NA	0.79 25 E	0.87 25 E	0.46 30 C	NA	NA	0.84 25 E	0.90 25 E
R4N. Atlantic Ave. Off: from Central Artery	1.03 20 F	1.40 15 F	NA	NA	1.04 20 F	1.06 20 F	1.13 20 F	NA	NA	1.23 20 F	1.13 20 F
R5N. Atlantic Ave. On: to Central Artery	0.53 15 F	0.66 15 F	1.18 15 F	1.18 15 F	0.76 25 F	0.74 25 F	0.76 15 F	1.20 15 F	1.18 15 F	0.64 25 F	0.78 25 F
R6N. Callahan Tunnel Off: from Central Artery	0.47 20 F	0.90 20 F	0.09 30 C	0.33 30 C	0.16 30 C	0.33 30 C	0.99 15 E	0.26 30 C	0.33 30 C	0.16 30 C	0.33 30 C
R7N. Sumner Tunnel On: to Central Artery	0.87 30 E	0.96 15 F	0.86 15 F	0.84 15 F	0.91 15 F	0.88 15 F	0.98 15 F	1.08 10 F	1.05 10 F	1.08 10 F	0.97 10 F
R8N. Storrow Drive Off: from Central Artery	0.37 40 C	0.55 40 C	0.53 40 C	0.57 40 C	0.61 40 C	0.58 40 C	0.56 40 C	0.55 40 C	0.51 40 C	0.56 40 C	0.64 30 D
R9N. Storrow Drive On: to Central Artery	1.37 10 F	*	0.91 25 E	0.99 20 F	0.91 25 E	0.99 25 E	*	1.09 20 F	1.17 20 F	1.06 20 F	1.04 20 F
R17N. Connector C-T: Central Artery to Mass. Tpk./Kneeland St.	NA	NA	0.54 40 C	0.52 40 C	NA	NA	NA	0.58 40 C	0.57 40 C	NA	NA
R18N. Ramp C-C: Frontage Rd. to Fort Point Channel	NA	NA	0.97 30 E	0.92 30 E	NA	NA	NA	1.01 25 F	0.99 30 E	NA	NA

Table 24

LEVEL OF SERVICE TOTALS

REGIONAL HIGHWAY NETWORK[1]

1990 AM PEAK

Level of Service	1982		Alt. 1		Alternative 2 Exist. Rdwys.		Alternative 2 Proj. Rdwys.		Alternative 3 Exist. Rdwys.		Alternative 3 Proj. Rdwys.		Alternative 4 Exist. Rdwys.		Alternative 4 Proj. Rdwys.		Alternative 5 Exist. Rdwys.		Alternative 5 Proj. Rdwys.	
A-D	25	(46)	21	(42)	25	(60)	20	(67)	24	(59)	23	(70)	30	(61)	22	(85)	28	(58)	25	(86)
E	9	(17)	6	(12)	10	(24)	6	(20)	9	(22)	6	(18)	7	(14)	1	(4)	7	(15)	2	(7)
F	20	(37)	23	(46)	7	(16)	4	(13)	8	(19)	4	(12)	12	(25)	3	(11)	13	(27)	2	(7)
TOTAL[2]	54	(100)	50	(100)	42	(100)	30	(100)	41	(100)	33	(100)	49	(100)	26	(100)	48	(100)	29	(100)

1990 PM PEAK

Level of Service	1982		Alt. 1		Alternative 2 Exist. Rdwys.		Alternative 2 Proj. Rdwys.		Alternative 3 Exist. Rdwys.		Alternative 3 Proj. Rdwys.		Alternative 4 Exist. Rdwys.		Alternative 4 Proj. Rdwys.		Alternative 5 Exist. Rdwys.		Alternative 5 Proj. Rdwys.	
A-D	22	(41)	19	(40)	24	(56)	24	(80)	23	(55)	25	(76)	25	(50)	24	(96)	24	(49)	25	(89)
E	4	(7)	2	(5)	4	(9)	1	(3)	4	(9)	3	(9)	6	(12)	1	(4)	6	(13)	3	(11)
F	28	(52)	26	(55)	15	(35)	5	(17)	15	(36)	5	(15)	19	(38)	0	(0)	19	(38)	0	(0)
TOTAL	54	(100)	47	(100)	43	(100)	30	(100)	42	(100)	33	(100)	50	(100)	25	(100)	49	(100)	28	(100)

2010 AM PEAK

Level of Service	1982		Alt. 1		Alternative 2 Exist. Rdwys.		Alternative 2 Proj. Rdwys.		Alternative 3 Exist. Rdwys.		Alternative 3 Proj. Rdwys.		Alternative 4 Exist. Rdwys.		Alternative 4 Proj. Rdwys.		Alternative 5 Exist. Rdwys.		Alternative 5 Proj. Rdwys.	
A-D	25	(46)	16	(32)	20	(48)	20	(67)	19	(46)	22	(67)	23	(47)	21	(84)	21	(44)	24	(86)
E	9	(17)	6	(12)	7	(16)	3	(10)	6	(15)	5	(15)	9	(18)	2	(8)	9	(18)	2	(7)
F	20	(37)	28	(56)	15	(36)	7	(23)	16	(39)	6	(18)	17	(35)	2	(8)	18	(38)	2	(7)
TOTAL	54	(100)	50	(100)	42	(100)	30	(100)	41	(100)	33	(100)	49	(100)	25	(100)	48	(100)	28	(100)

2010 PM PEAK

Level of Service	1982		Alt. 1		Alternative 2 Exist. Rdwys.		Alternative 2 Proj. Rdwys.		Alternative 3 Exist. Rdwys.		Alternative 3 Proj. Rdwys.		Alternative 4 Exist. Rdwys.		Alternative 4 Proj. Rdwys.		Alternative 5 Exist. Rdwys.		Alternative 5 Proj. Rdwys.	
A-D	22	(41)	19	(40)	21	(48)	20	(67)	19	(44)	24	(73)	25	(49)	20	(80)	22	(44)	25	(89)
E	4	(7)	4	(8)	6	(13)	4	(13)	6	(14)	3	(9)	5	(10)	5	(20)	7	(14)	2	(7)
F	28	(52)	25	(52)	17	(39)	6	(20)	18	(42)	6	(18)	21	(41)	0	(o)	21	(42)	1	(4)
TOTAL	54	(100)	48	(100)	44	(100)	30	(100)	43	(100)	33	(100)	51	(100)	25	(100)	50	(100)	28	(100)

1 Number and percentage (in parentheses) of selected roadway link and ramp sections which fall into the Level of Service category(s) indicated.

2 Totals by alternative may vary due to project addition/elimination of links, and links with inconsistent data, which were not considered further.

total to 32 percent of total in the AM peak, and from 41 percent of total to 40 percent of total in the PM peak. In general, AM peak hour LOS degradation will be more significant than during the PM peak hour.

All project alternatives in 1990 and 2010 during both peak hours will improve overall LOS on the selected regional highway links and ramps. In 2010, existing highway locations with LOS F operations will be reduced from 56 percent of total to 35-39 percent of total during the AM peak hour and from 52 percent of total to 39-42 percent of total during the PM peak hour. In 2010, existing highway locations with A-D operation will increase from 32 percent of total to 44-48 percent of total during the AM peak hour and from 40 percent of total to 44-49 percent of total during the PM peak hour. In general the AM peak hour will experience more significant LOS improvement than the PM peak hour with the proposed project.

On new project roadways in the year 2010 (highway links and ramps), 67 to 86 percent of these new highway sections will operate within the acceptable LOS A-D range during the AM peak and 67 to 89 percent during the PM peak. Year 2010 LOS F operations will occur on 7 to 23 percent of project roadways during the AM peak and from 0 to 20 percent of project roadways during the PM peak, indicating that overall operating conditions on the project roadways will be substantially better than those on the existing connecting highways.

Comparing the relative effectiveness of the four build alternatives in terms of overall regional highway network LOS improvement, the differences are not significant. However, the Boston two-way alignment alternatives (Alternatives 4 and 5) are somewhat more effective than the split alignment alternatives (2 and 3). For a given Boston-side alignment, the differences between the East Boston alignments (railroad or airport) are negligible or non-existent from the standpoint of overall regional highway network LOS improvement.

Major Highway Links

Table 25 aggregates and summarizes the level of service computations for individual highway links, contained in Tables 22 and 23, to permit a more simplified analysis to be performed of the critical regional highway links to be affected by the proposed project.

Level of Service Without the Project. As summarized in Table 25, without the proposed project, AM and PM peak hour levels of service will remain the same or degrade further on the selected highway links, as traffic increases. The one exception will be the Mystic-Tobin Bridge, whose AM peak hour level of service will improve (from F to E) because of the MDPW's North Area Central Artery project.

In the Sumner Tunnel, 2010 AM peak hour level of service will remain at its 1982 level of F under No-Build traffic loadings, but with increased congestion from 1982 (v/c = 1.17 to 2010 v/c = 1.37). The existing (1982) constriction point of the tunnel is the East Boston entrance, where traffic exiting seven toll booths is funnelled into the two-lane tunnel. In 1990 and 2010, the toll plaza's capacity will also be exceeded. Operating speeds in the tunnel itself will average 20 mph. In the PM peak hour, 1982 LOS F conditions will also continue, but again with increased congestion (from 1982 v/c = 0.98 to 2010 v/c = 1.21), and operating speeds will average less than 20 mph. Similarly, in the Callahan Tunnel, existing PM peak hour congestion (LOS F, v/c = 1.06) will be more pronounced in the future with the No-Build Alternative. LOS F conditions will still prevail, but with higher v/c ratios (1.51 by 2010). By 2010, average operating speed in the tunnel will decrease, from 20 mph in 1982 and 1990 to 15 mph. The existing constriction point of this facility is the Boston entrance; however, by 1990,

Table 25

LEVEL OF SERVICE SUMMARY
BUILD VS. NO-BUILD ALTERNATIVES - SELECTED HIGHWAY LINKS

	Peak Direction Level of Service					
	1982 (Existing)		2010 No-Build Alternative		2010 Build Alternatives	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Interstate Route 93	F	C	F	C	F	C
Mystic-Tobin Bridge	F	C	E	E	C-D	C-D
Storrow Drive, w. of Copley Sq.	C	C	C	C	C	C-D
Central Artery No. of Tunnels	E-F	E-F	E-F	E-F	E-F	E-F
Callahan Tunnel	D	F	F	F	C-D	D-E
Sumner Tunnel	F	F	F	F	E	C
Central Artery So. of Tunnels	E-F	F	F	F	D-F	B-F
Third Harbor Tunnel	-	-	-	-	C	C-D
Massachusetts Turnpike	D	B	E	C	E	C
Southeast Expressway	F	E-F	F	F	F	F
Route 1A North of Airport	A	A	A	A-B	A-C	C

the toll plaza's capacity will also be exceeded.

On the northbound Central Artery/Expressway, in the AM peak, where existing (1982) LOS E or F conditions prevail from Columbia Road to the Charlestown High-Level Bridge, and where v/c ratios range from 0.90 to 1.13, corresponding 2010 LOS E or F conditions will still prevail, but with higher v/c ratios, ranging from 0.91 to 1.62. Existing average speeds of 20 to 35 mph will drop to 10 to 25 mph by 2010. Southbound, existing LOS F conditions from the High-Level Bridge through the Dewey-Square Tunnel will continue by 2010. In fact, congested LOS F conditions will extend further south, to Southampton Street. Existing average operating speeds of 20 to 35 mph will drop to 20 to 25 mph in year 2010.

In the PM peak hour, northbound operating conditions from Columbia Road to the Charlestown High-Level Bridge will continue to deteriorate to LOS E and F under future traffic loadings, with 2010 v/c ratios ranging from 0.91 to 1.11. Operating speeds of 35 mph, south of Massachusetts Avenue, and 15 mph within and north of the Dewey Square Tunnel, will prevail in 2010, as compared with 1982 speeds of 40 and 15 mph, respectively. Southbound in the PM peak hour, existing LOS F conditions will be exacerbated by the increases in traffic volumes, as evidenced by higher v/c ratios and lower operating speeds on some links.

As an indicator of the increased congestion expected in the Callahan/Sumner Tunnels, an estimate of the number of congested hours of operation (LOS E or F) in the Callahan/Sumner Tunnels has been made for 2010 No-Build conditions. This estimate assumes that existing patterns of hourly distribution of tunnel traffic will continue, in a relative sense, into the future. With the No-Build Alternative, the Sumner Tunnel will experience congested LOS E or F conditions for five of the six AM hours between 6 AM and 12 noon in 2010. This can be compared to existing AM LOS E or F congestion which typically occurs for three hours, between 7 AM and 10 AM. In the PM, 2010 LOS E or F conditions will occur for nine hours, from 12 noon to 9 PM, as compared to an existing two hour congestion period (4 to 6 PM). In the Callahan Tunnel, existing operations are typically not congested during the morning. However, by 2010, LOS E or F conditions will occur from 6 AM to 12 noon. In the afternoon, the existing five-hour period of congestion (1 PM to 6 PM) will increase to eight hours (from 12 noon to 8 PM) under 2010 traffic conditions. In summary, then, congested (LOS E or F) operation in both tunnels is estimated to increase from five hours per day in 1982 to 14 hours per day in 2010.

Level of Service Comparisons: Build vs. No Build. From Table 25, the most significant changes in level of service will occur on the existing cross-harbor facilities as a result of the proposed project. Future levels of service in the Sumner Tunnel will improve from LOS F operation in 1982 in both peaks with the No-Build Alternative to LOS E (v/c = 0.93-0.94) and C (v/c = 0.67-0.73) for the respective AM and PM peak hours. Average speeds in the tunnel will increase from about 20 mph to 30-35 mph with the various build alternatives, as a result of reduced congestion.

For the Callahan Tunnel, operations will improve significantly from LOS F in 2010 with the No-Build Alternative to LOS C or D in the AM peak (v/c = 0.65-0.80) and D or E in the PM peak (v/c = 0.86-0.93). Typical speeds will increase from 15-20 mph to 30-35 mph. On the Mystic-Tobin Bridge, operations will improve from LOS E (v/c = 0.90) in the northbound direction during the PM peak to LOS C-D (v/c = 0.77-0.81). In the proposed tunnel, LOS C operation will occur during the AM peak both inbound and outbound, and LOS C inbound and LOS D outbound during the PM peak. Operating speeds will range

from 35 to 40 mph. These cross-harbor levels of service reflect the redistribution of traffic creating more balanced operating conditions on all harbor crossing facilities.

To emphasize the improved operating conditions on the existing cross-harbor facilities, the number of congested hours (LOS E or F) of operation daily has been estimated under 2010 build alternative conditions. The Sumner Tunnel will operate at LOS E for one hour in the AM under the build alternatives, as compared with five hours at LOS E or F for the No-Build Alternative. In the PM, the Sumner Tunnel will remain free-flowing as compared with nine hours of congested operation under the No-Build Alternative. In the Callahan Tunnel, conditions will be free-flowing all day, or at worst, all but one hour, under the build alternatives, as compared with 14 hours under the No-Build Alternative. In summary, then, congested hours (LOS E or F) of operation in the Callahan/Sumner Tunnels are estimated to decrease from 14 hours per day to a maximum of one hour a day under the build alternatives.

Operations on the Mystic-Tobin Bridge will also improve under the build alternatives, generally from LOS E operation during both peaks under the No-Build Alternative in 2010 to C-D operation. The two hours of (LOS E-F) congestion (AM peak hour and PM peak hour) which would exist under the No-Build Alternative in 2010 will be eliminated.

In general, operating conditions on the Central Artery north of the existing tunnels and the Southeast Expressway south of Massachusetts Avenue will remain the same under the No-Build and build alternatives in the year 2010. On the Central Artery south of the existing tunnels, some LOS improvements will result. Under the split alignment alternatives (2 and 3), LOS will improve from F to C southbound during both peak hours generally within the Dewey Square Tunnel because of the proposed six-lane southbound cross-section. Northbound, the five lane cross-section in Fort Point Channel will improve LOS for this section of the Artery from F to B in the PM and F to D in the AM.

Interstate Route 93, Storrow Drive, Massachusetts Turnpike and Route 1A north of the airport will not experience significant changes in levels of service in 2010 between the build and No-Build alternatives. LOS on the former two highway sections will remain essentially the same. LOS on Route 1A north of the airport will degrade because of increased traffic during the PM peak hour, and that only from LOS A or B to C, certainly within acceptable levels. Although not noted in Table 25, the Route 1A approaches to the Callahan/Sumner Tunnel toll plazas will experience improved levels of service in 2010 due to the diversion of traffic from these tunnels to the Third Harbor Tunnel. Southbound LOS will improve from F to C and northbound from C to A during the AM peak hour; during the PM peak hour, southbound LOS will improve from F to C, while northbound LOS will remain at C.

<u>Level of Service Comparisons Among Build Alternatives</u>. From Tables 22 and 23, the majority of the existing (common) highway links will be similarly affected by all four build alternatives in terms of levels of service. Variations between alternatives which do exist are most notable for the Callahan Tunnels and the Mystic-Tobin Bridge, where the railroad alignment alternatives (2 and 4) result in slightly greater traffic diversions, and consequently, slightly more improved LOS (e.g., from E to D and D to C). The split-alignment alternatives (2 and 3) do effect more significant LOS improvements on project sections of the Central Artery south of the existing tunnels, as indicated previously (e.g., LOS F to C on six-lane southbound Dewey Square Tunnel project section during both peak hours; F to B in PM and F to D in AM on five-lane Fort Point Channel Artery northbound tunnel section).

Otherwise, the level of service impacts of the four build alternatives on the remaining regional highway sections are generally comparable.

South Boston Intersections

South Boston as a Whole

Tabulation of the study intersections in South Boston by level of service values is contained in Table 26. This tabulation was prepared from Tables 22 and 23.

From Table 26, without the project, the South Boston intersections as a whole will suffer increased level of service degradation between 1982 and 2010 during both peak hours because of increased traffic flowing through South Boston. For several of these intersections, which parallel the Central Artery (i.e., along Dorchester Avenue and Albany Street), the increases will be attributable to Southeast Expressway/Central Artery traffic continuing to seek to avert congestion on the express highway by diverting (short-cutting) to adjacent local streets. For the Fort Point Channel crossings in the northern section of South Boston, the increased traffic will be a combination of this same Artery short-cutting traffic plus traffic generated by the substantial new development expected to occur in this section of South Boston. Percentagewise, the number of South Boston intersections with LOS F operations in the AM peak will increase from 26 percent in 1982 to 43 percent in 2010; the number of intersections with LOS F operations in the PM Peak will increase from 33 percent in 1982 to 43 percent in 2010. Conversely, the number of intersections with LOS A-D operations in the AM peak will decrease from 67 percent in 1982 to 29 percent in 2010; in the PM peak, they will decrease from 67 percent in 1982 to 50 percent in 2010. The South Boston intersections as a whole will experience more significant LOS degradation in the AM peak than in the PM peak.

All project alternatives in 1990 and 2010 during both peak hours will improve overall LOS at the selected South Boston intersections. This will be largely attributable to removing much of the regional through traffic which was utilizing South Boston streets to avoid Central Artery congestion under the No-Build Alternative. Also, connections between the Central Artery/Expressway/Tunnel (ramps at Summer Street) and the northern sector of South Boston exist as part of the project, plus relocated Dorchester Avenue, all of which will direct new development traffic away from the South Boston residential areas. LOS improvements by the build alternatives will include increases in LOS A-D operations from 29 percent (No-Build) to 40 to 47 percent of the intersections in the AM peak and from 50 percent (No-Build) to 53 to 60 percent of the intersections in the PM peak in 2010. LOS F operations will remain at approximately the same number of intersections. As suggested from the above, the AM peak hour will experience more significant LOS improvement than the PM peak hour at these intersections.

Comparing the relative effectiveness of the four alternatives indicates that the two-way alignment alternatives (4 and 5) are somewhat more effective than the split alignment alternatives in improving overall LOS at these South Boston intersections.

Individual Intersections

Level of Service Changes Without the Project. Two intersections which operate at LOS F during both peak hours in 1982, Congress Street/Dorchester Avenue and Northern Avenue/Sleeper Street, will continue to do so through 2010, but at increased congestion levels (higher v/c ratios). In addition, two other intersections in the AM peak, Andrew Square and Berkeley Street/West Fourth Street/Frontage Road, and three other intersections in the PM peak, Columbia Road/Day Boulevard/L Street,

Table 26

LEVEL OF SERVICE TOTALS
SOUTH BOSTON INTERSECTIONS[1]

Level of Service	1982		1990 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	10	(67)	4	(26)	7	(47)	7	(47)	7	(47)	7	(47)
E	1	(7)	4	(27)	2	(13)	2	(13)	3	(20)	3	(20)
F	4	(26)	7	(47)	6	(40)	6	(40)	5	(33)	5	(33)
TOTAL[2]	15	(100)	15	(100)	15	(100)	15	(100)	15	(100)	15	(100)

Level of Service	1982		1990 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	10	(67)	7	(50)	8	(53)	8	(53)	9	(60)	9	(60)
E	0	(0)	1	(7)	1	(7)	1	(7)	0	(0)	0	(0)
F	5	(33)	6	(43)	6	(40)	6	(40)	6	(40)	6	(40)
TOTAL	15	(100)	14	(100)	15	(100)	15	(100)	15	(100)	15	(100)

Level of Service	1982		2010 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	10	(67)	4	(29)	6	(40)	6	(40)	7	(47)	7	(47)
E	1	(7)	4	(28)	3	(20)	3	(20)	2	(13)	2	(13)
F	4	(26)	6	(43)	6	(40)	6	(40)	6	(40)	6	(40)
TOTAL	15	(100)	14	(100)	15	(100)	15	(100)	15	(100)	15	(100)

Level of Service	1982		2010 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	10	(67)	7	(50)	8	(53)	8	(53)	9	(60)	9	(60)
E	0	(0)	1	(7)	1	(7)	1	(7)	0	(0)	9	(0)
F	5	(33)	6	(43)	6	(40)	6	(40)	6	(40)	6	(40)
TOTAL	15	(100)	14	(100)	15	(100)	15	(100)	15	(100)	15	(100)

1 Number and percentage (in parentheses) of selected intersections which fall into the Level of Service category(s) indicated.

2 Totals by alternative may vary somewhat due to elimination of intersections with inconsistent data.

Dorchester Avenue/West Broadway, and Congress Street/A Street, will also continue to operate at LOS F through that time period. In addition, by 2010, three intersections will degrade from LOS C-E to LOS F in the AM peak hour, Columbia Road/Day Boulevard/L Street, Congress Street/A Street, and Herald Street/Broadway/Frontage Road/Albany Street, with v/c ratios in excess of 1.0. The Summer Street/Dorchester Avenue intersection will similarly degrade from LOS C to F during the PM peak hour. These locations are concentrated along lower Dorchester Avenue, at the Broadway Bridge, and at Frontage Road along the Central Artery, the local bypass routes in South Boston, and at the South Boston intersections at the Fort Point Channel, also bypass routes, but additionally carrying new development traffic to the northern sector of South Boston.

Level of Service Comparisons: Build vs. No Build. The differences in v/c ratios and LOS at the selected intersections between the build alternatives and the No-Build Alternative are generally minor at 12 of the 15 intersections studied in 2010 although overall improvement is reflected by the build alternatives. The exceptions are as follows:

(1) Summer Street/Dorchester Avenue will degrade from LOS E to LOS F operation in the AM peak, with v/c ratios in excess of 1.0, due to the presence of the Summer Street ramps to the Third Harbor Tunnel and the Dorchester Avenue off-ramp from the Fort Point Channel tunnel.

(2) Herald Street/Broadway/Frontage Road/Albany Street will improve from LOS F in the AM peak hour to LOS C-D (v/c = 0.79 to 0.86) and from LOS E in the PM peak hour to LOS B (v/c = 0.61 to 0.68).

(3) Dorchester Avenue/West Fifth Street/A Street will improve from LOS D in the PM peak hour to LOS B (v/c = 0.59-0.61).

Level of Service Comparisons Among Build Alternatives. The LOS differences between the build alternatives are non-existent at 9 of the 15 selected intersections in the AM peak hour and at 13 of 15 intersections in the PM peak hour. At the remaining intersections, LOS changes are only one level upward or downward (e.g. B to C, E to D), and therefore are minor. From those intersections with differing LOS's, and from the previous discussions on the South Boston intersections as a whole, it appears that the two-way alignment alternatives (4 and 5) are slightly more effective in relieving traffic congestion in South Boston than the split alignment alternatives (2 and 3).

East Boston and Revere Intersections

East Boston and Bell Circle (Revere) as a Whole

Tabulation of the study intersections in East Boston and Bell Circle in Revere by level of service values is contained in Table 27. This tabulation was prepared from Tables 22 and 23.

From Table 27, without the project, the selected East Boston and Revere intersections will experience overall level of service degradation between 1982 and 2010 during both peak hours, because of traffic increases through East Boston, especially traffic attributed to the increased development and airport activity expected to occur at Logan Airport. Some overflows of this airport traffic will occur on streets such as Porter and Bennington, as they do today. Percentagewise, the number of East Boston and Revere intersections with LOS F operations in the AM peak will increase from 11 percent in 1982 to 25 percent in 2010; in the PM peak LOS F intersections will increase from 6 percent in 1982 to 19 percent in 2010. Overall, these proportions of LOS F intersections to total intersections are low, and not nearly as significant as for the regional highway network or South Boston. Conversely, the percentage of LOS A-D

Table 27

LEVEL OF SERVICE TOTALS
EAST BOSTON AND REVERE INTERSECTIONS[1]

Level of Service	1982		1990 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	16	(89)	12	(75)	13	(81)	13	(81)	13	(81)	13	(81)
E	0	(0)	2	(12)	1	(6)	2	(13)	1	(6)	2	(13)
F	2	(11)	2	(13)	2	(13)	1	(6)	2	(13)	1	(16)
TOTAL	18	(100)	16	(100)	16	(100)	16	(100)	16	(100)	16	(100)

Level of Service	1982		1990 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	15	(83)	13	(81)	13	(81)	14	(87)	13	(81)	14	(87)
E	2	(11)	1	(6)	0	(0)	0	(0)	0	(0)	0	(0)
F	1	(6)	2	(13)	3	(19)	2	(13)	3	(19)	2	(13)
TOTAL	18	(100)	16	(100)	16	(100)	16	(100)	16	(100)	16	(100)

Level of Service	1982		2010 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	16	(89)	11	(69)	12	(75)	13	(81)	12	(75)	13	(81)
E	0	(0)	1	(6)	2	(12)	2	(13)	2	(12)	2	(13)
F	2	(11)	4	(25)	2	(13)	1	(6)	2	(13)	1	(6)
TOTAL	18	(100)	16	(100)	16	(100)	16	(100)	16	(100)	16	(100)

Level of Service	1982		2010 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	15	(83)	10	(63)	13	(81)	13	(81)	13	(81)	13	(81)
E	2	(11)	3	(18)	1	(6)	1	(6)	1	(6)	1	(6)
F	1	(6)	3	(19)	2	(13)	2	(13)	2	(13)	2	(13)
TOTAL	18	(100)	16	(100)	16	(100)	16	(100)	16	(100)	16	(100)

1 Number and percentage (in parentheses) of selected intersections which fall into the Level of Service category(s) indicated.

2 Totals by alternative may vary somewhat due to elimination of intersections with inconsistent data.

intersections will decrease from 89 percent in 1982 to 69 percent in 2010 during the AM peak without the project; during the PM peak, LOS A-D intersections will decrease from 83 percent to 63 percent, again high in comparison to the regional highway network and South Boston intersections.

All project alternatives in 1990 and 2010 during both peak hours will improve overall LOS at the selected East Boston and Revere intersections. Much of this improvement is attributable to removal of future airport-related and tunnel-related traffic attempting to short-cut congestion on the Route 1A approaches to the existing tunnels and on the airport access/egress roadway system by utilizing local streets. This traffic is placed back onto Route 1A and the airport access/egress roadway system as these routes' loadings are lightened by the Third Harbor Tunnel alternatives and their connections to the airport and Route 1A north. LOS improvements by the build alternatives will include increases in LOS A-D operations in 2010 from 69 percent (No Build) to 75 to 81 percent in the AM peak and from 63 percent to 81 percent in the PM peak. LOS F operations will decrease in 2010 from 25 percent of the intersections (No Build) to 6 to 13 percent during the AM peak, and from 19 percent to 13 percent in the PM peak. At maximum, only two intersections will operate at LOS F. Both peak hours result in approximately equal LOS improvement from the build alternatives when both LOS A-D and LOS F operations are considered.

Comparing the relative effectiveness of the four build alternatives indicates that the airport alignment alternatives (Alteratives 3 and 5) have a slight edge overall, compared to the railroad alignment alternatives (Alternatives 2 and 4).

Individual Intersections

Level of Service Changes Without the Project. During the AM peak, two intersections which operate at LOS F in 1982 will continue to do so in 2010 without the project: Porter Street/London Street and Bell Circle in Revere (v/c's will be in excess of 1.0). Two intersections operating at LOS E or better in 1982 will degrade to LOS F during both peak hours in 2010, Porter Street/Chelsea Street/Visconti Road and Porter Street/Bremen Street. Bell Circle in Revere, which operates at LOS D in 1982 during the PM peak hour (v/c = 0.89) will degrade to LOS F in 2010 also. All the Porter Street intersections fall along the secondary (local) access route to the airport, while Bell Circle is along the "backdoor" route to the airport (Interstate Route 93 to Route 16 to Route 60).

Level of Service Comparisons: Build vs. No-Build. During the AM peak hour in 2010, only one intersection will degrade to LOS F for the build alternatives compared to the No-Build, and that only under Alternatives 2 and 4 (railroad alignment): the Airport Crossover Roads intersection, from LOS E (v/c = 0.94). LOS will only degrade at one additional intersection, McClellan Off-Ramp/Neptune Road (LOS D to E). During the PM peak in 2010, LOS will degrade to F at two intersections: McClellan off-ramp/Neptune Road for Alternatives 3 and 5 (from No-Build LOS E) and the Airport Crossover Roads intersection for Alternatives 2 and 4 (from No-Build LOS E). No other intersections will experience degradation of LOS during the PM peak hour. LOS's and v/c's for the remaining intersections will remain approximately the same or improve during both peak hours.

Level of Service Comparisons Among Build Alternatives. Nine intersections in the AM peak and 10 intersections in the PM peak, the majority studied, will experience the same levels of service under all build alternatives. An additional six intersections in the AM peak and four intersections in the PM peak have

build alternative LOS's that differ only by one level (e.g., B-C, E-D). The remaining intersections whose build alternatives have more significant LOS differences include the Airport Crossover Roads intersections during both peaks, with the airport alignments (Alternatives 3 and 5) having the more improved LOS, as indicated previously, and the Porter Street/Orleans Street intersection during the PM peak, with the railroad alignments (Alternatives 2 and 4) having the more improved LOS. In terms of LOS improvements at local East Boston intersections and at Bell Circle in Revere, the four build alternatives are approximately equal in effectiveness, but with Alternatives 3 and 5 (airport alignments) having a slight edge, including relief of congestion on the airport access/egress roadway system.

Downtown Boston Intersections

Downtown Boston as a Whole

Tabulation of the study intersections in Downtown Boston by level of service values is contained in Table 28. This tabulation was prepared from Tables 22 and 23.

From Table 28, without the project, the selected intersections in Downtown Boston will experience overall degradation in level of service between 1982 and 2010 during both peak hours, as traffic increases in the Boston area. Percentagewise, the number of downtown Boston intersections with LOS F operations in both the AM and PM peaks in 2010 will increase from 45 (1982) to 67 percent, while LOS A-D operations will decrease from 33 percent (1982) to 11 percent in the 2010 AM peak and from 55 percent (1982) to 22 percent in the PM peak.

The build alternatives, in general, will neither significantly improve or degrade overall LOS at these Downtown Boston intersections. As indicated in Table 28, absolute increases in the number of intersections which will operate at LOS A-D levels (by one to three) will occur for some alternatives, but so also will absolute increases occur of the number of intersections which will operate at LOS F (by one to two) for others. Other alternatives intersection totals will remain at No-Build totals for LOS A-D operation or even improve (reduce to below) No-Build totals for LOS F operation. Comparing the relative effectiveness of the four build alternatives, Alternatives 4 and 5 (two-way alignments) are more effective overall than Alternatives 2 and 3 in terms of favorable LOS operations.

Individual Intersections

Level of Service Changes Without the Project. Four intersections which operate at LOS F in 1982 during both peak hours will continue to do so in 2010: Dewey Square, Atlantic Avenue/Northern Avenue, North Street/Blackstone Street/Southbound Off-Ramp, and Cross Street/Hanover Street/Salem Street. Two other intersections will degrade to LOS F during both peak hours between 1982 and 2010: Atlantic Avenue/Congress Street and Atlantic Avenue/Surface Artery/High Street. Kneeland Street will degrade from LOS B-D during both peak hours between 1982 and 2010 to LOS E (v/c = 0.90 to 0.97). LOS at the remaining intersections will remain unchanged and will operate at LOS E or better.

Level of Service Comparisons: Build vs. No Build. Six intersections in the 2010 AM peak and four intersections in the PM peak under the build alternatives will experience the same levels of service as for the No Build Alternative. Only two intersections will degrade to LOS F under the build alternatives, both during the AM peak, and both under Alternatives 2 and 3. The most significant change is at Purchase Street/Congress Street under these alternatives, LOS increasing from B to F. Significant LOS improvements will occur at the Kneeland Street/Surface Artery/Southbound On-Ramp intersection during both peak hours under

Table 28

LEVEL OF SERVICE TOTALS
DOWNTOWN BOSTON INTERSECTIONS[1]

Level of Service	1982		1990 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	3	(33)	1	(7)	2	(20)	2	(20)	4	(36)	4	(36)
E	2	(22)	0	(0)	1	(10)	0	(0)	0	(0)	0	(0)
F	4	(45)	5	(83)	7	(70)	8	(80)	7	(64)	7	(64)
TOTAL	9	(100)	6	(100)	10	(100)	10	(100)	11	(100)	11	(100)

Level of Service	1982		1990 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	5	(55)	2	(33)	3	(30)	3	(30)	6	(55)	5	(46)
E	0	(0)	1	(17)	1	(10)	2	(20)	2	(18)	2	(18)
F	4	(45)	3	(50)	6	(60)	5	(50)	3	(27)	4	(36)
TOTAL	9	(100)	6	(100)	10	(100	10	(100)	1	(100)	11	(100)

Level of Service	1982		2010 AM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	3	(33)	1	(11)	1	(10)	1	(10)	4	(36)	4	(36)
E	2	(22)	2	(22)	1	(10)	1	(10)	1	(9)	1	(9)
F	4	(45)	6	(67)	8	(80)	8	(10)	6	(55)	6	(55)
TOTAL	9	(100)	9	(100)	10	(100)	10	(100)	11	(100)	11	(100)

Level of Service	1982		2010 PM Peak Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
A-D	5	(55)	2	(22)	4	(40)	3	(30)	4	(36)	5	(46)
E	0	(0)	1	(11)	0	(0)	0	(0)	2	(18)	2	(18)
F	4	(45)	6	(67)	6	(60)	7	(70)	5	(46)	4	(36)
TOTAL	9	(100)	9	(100)	10	(100)	10	(100)	11	(100)	11	(100)

1 Number and percentage (in parentheses) of selected intersections which fall into the Level of Service category(s) indicated.

2 Totals by alternative may vary somewhat due to project addition/elimination of intersections, and intersections with inconsistent data, which were not considered further.

Alternatives 2 and 3, from E to A-B in the AM peak and E to C in the PM peak. The Dorchester Avenue/Northern Avenue intersection will also improve significantly, from LOS C to A, during the PM peak for Alternatives 4 and 5. LOS will not change at all, or at most will change upward or downward by one level, at the remaining intersections.

Level of Service Comparisons Among Build Alternatives. Six intersections in the AM peak and four intersections in the PM will experience the same LOS levels under the build alternatives, and equal also to the LOS levels for the No-Build Alternative, as indicated above. At the remaining intersections common to all four build alternatives, Alternatives 4 and 5 result in LOS improvements at two intersections during the AM peak hour and three intersections during the PM peak hour, as compared to one intersection respectively for both the AM and PM peak hours under Alternatives 2 and 3. As indicated previously, Alternatives 4 and 5 generally appear more effective than Alternatives 2 and 3 in terms of more favorable LOS operations at the Downtown Boston intersections.

4.2.3 Central Artery Bottlenecks and Congestion Points

Without the Project

Existing and future Central Artery bottlenecks and congestion points with the No-Build Alternative, discussed in Section 3.1, will be briefly reiterated here. Reference should be made to Figure 11 for a graphical representation of Central Artery queues generated by these bottleneck and congested locations. As indicated in Section 3.1, these queues represent each bottleneck/congestion point's contribution to total queuing on the Central Artery; the queues shown are individual to each congestion source, and have not been added with others to develop the cumulative effect of total queuing on the Artery, so that the impacts of the project on individual queues can be assessed.

Year 1990

On the northbound Central Artery during the AM peak, three congestion points will generate queues onto the Central Artery: 1) East Berkeley Street on-ramp merge area; 2) the Massachusetts Turnpike on-ramp merge area; 3) the Northern Avenue on-ramp merge area. The former two areas generated queues on the Central Artery in 1982. Comparing the lengths of each queue for 1982 and 1990 conditions, the Massachusetts Turnpike on-ramp queue is essentially the same for both years; however, the East Berkeley Street on-ramp queue is actually shorter under 1990 conditions, due to the anticipated tendency for traffic to bypass the congested Central Artery via local streets, attempting to enter the northbound Central Artery at the northernmost practicable point. This also accounts for the 1990 queue generated from the Northern Avenue on-ramp merge area. Traffic will redistribute itself to other, less congested entry points to the Central Artery, such as the Northern Avenue on-ramp. In the southbound direction, an existing queue generated by the Haymarket Square on-ramp merge area will increase in 1990, due to increased demand on this ramp. Also, a new queue will be generated by the Callahan Tunnel off-ramp junction with North Street. The queue generated at Haymarket will extend onto the High-Level Bridge, while the queue from the Callahan Tunnel ramp will back up onto the Central Artery beyond the Causeway Street on-ramp. On Interstate 93 and the Mystic-Tobin Bridge, queues emanating from the Charlestown High-Level Bridge will typically extend back 1-1/2 miles on I-93 and 1-3/4 miles on the connecting ramp from the Mystic-Tobin Bridge.

During the 1990 PM peak on the northbound Central Artery, a queue comparable to existing conditions generated by the two-lane bottleneck on the approach to the High-Level Bridge will extend through the Dewey

Square Tunnel to East Berkeley Street. By 1990, three new congestion points will generate queues on the Central Artery: 1) from the Callahan Tunnel entrance extending onto the Central Artery nearly to the Congress Street off-ramp; 2) the Northern Avenue on-ramp merge area extending past the Massachusetts Turnpike on-ramp; and 3) the East Berkeley Street on-ramp merge area extending to the Massachusetts Avenue on-ramp. It is clear from these queues that northbound travel on the Central Artery/Expressway will be congested from Massachusetts Avenue to the I-93/Route 1 diverge in Charlestown. In the southbound direction under 1990 PM peak conditions, four specific congestion points will individually generate queues along the highway. The Albany Street on-ramp and Haymarket Square on-ramp merge areas will each generate queues on the Central Artery which are generally greater than those which exist today. The Columbia Road on-ramp will generate a shorter queue. The fourth queue, which extends up the Callahan Tunnel off-ramp onto the Central Artery mid-way between the Causeway Street on- and Haymarket Square off-ramps, is about the same as the existing queue at this location.

Year 2010

Continued growth in traffic to 2010 will increase queue lengths on the northbound Central Artery in the AM peak hour. In addition, increased demand for the Callahan Tunnel will create a queue on the off-ramp to the tunnel extending onto the Central Artery and nearly reaching the Northern Avenue on-ramp. Southbound in the AM peak, queues generated from the Haymarket Square on-ramp merge area and the Callahan Tunnel off-ramp will extend onto the High-Level Bridge and mid-way between the Causeway Street on- and Haymarket Square off-ramps, respectively. In addition, queues on Interstate 93 and the Mystic-Tobin Bridge will extend back 3-1/4 and 2-3/4 miles, respectively, from the congested High-Level Bridge. In the PM peak, northbound congestion points will create queues which, at some locations, will be substantially longer than those of 1990. In particular, the queue generated at the Callahan Tunnel entrance will extend onto the Central Artery and into the Dewey Square tunnel, nearly to South Street. The High-Level Bridge bottleneck will continue to affect northbound traffic flow, extending back through the Dewey Square Tunnel to the East Berkeley Street on-ramp. Southbound, in the PM peak hour, the four locations identified for 1990 will generate similar queues in 2010.

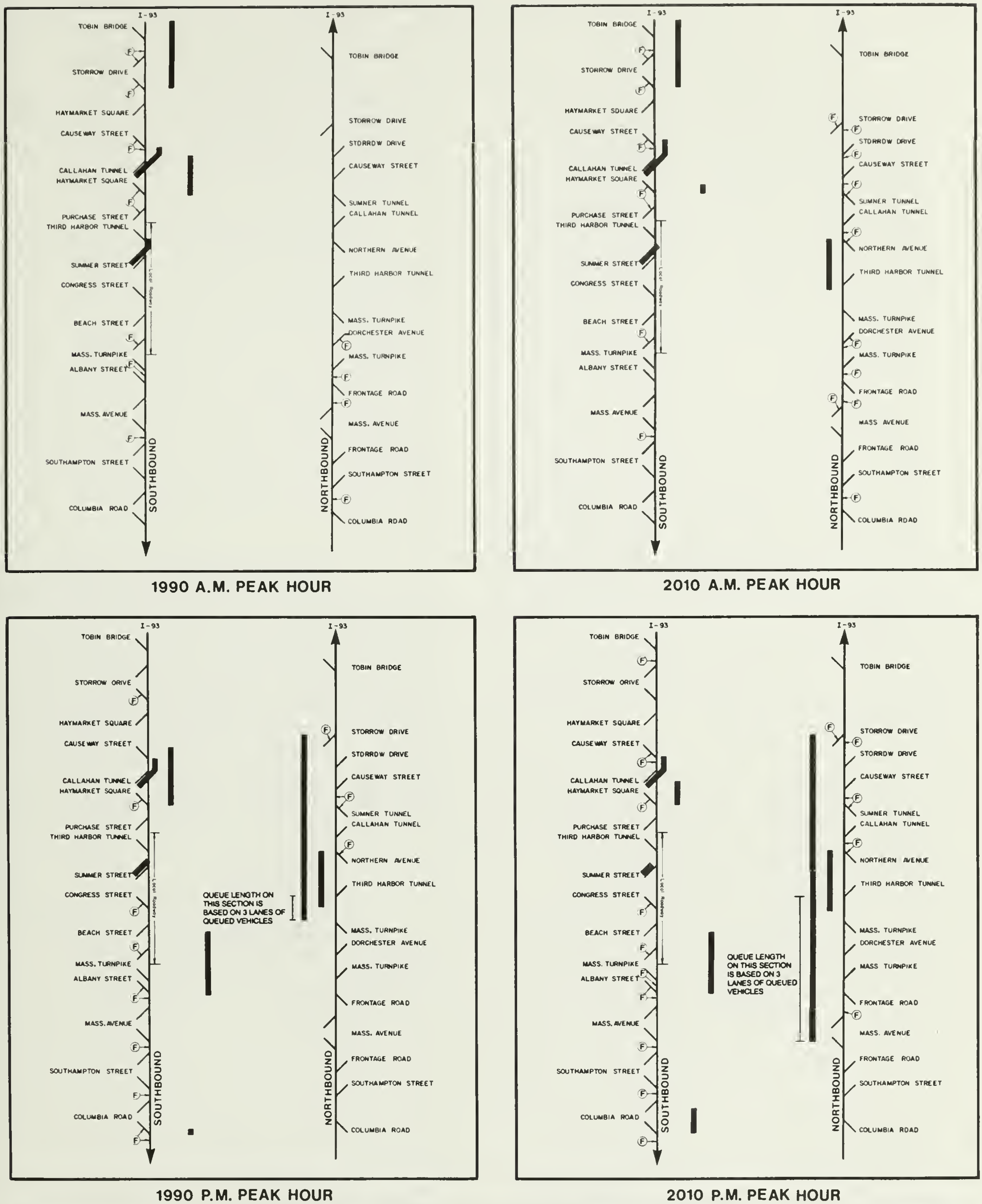
Build Alternatives

Graphic illustrations of Central Artery/Southeast Expressway congestion points and related queues are shown on Figures 31 through 34 for the four build alternatives. For comparison to the No-Build Alternative, reference may be made to Figure 11 in Section 3.1.

Since all four build alternatives have differing magnitudes of queues for specific congestion points common to all alternatives, and differing congestion points in some cases, each alternative is addressed separately.

Alternative 2

Year 1990. Alternative 2 (Figure 31) will essentially eliminate those queues expected under the No-Build Alternative on the northbound Central Artery during the AM peak. The Northern Avenue on-ramp merge queue (No-Build) will not occur because reduced Central Artery volumes will decrease merging friction; the Massachusetts Turnpike on-ramp queue will be eliminated because this area will be upgraded to a free flow entry onto the Central Artery; and the queue generated at the East Berkeley Street merge area will be eliminated by discontinuance of this ramp. In the southbound direction, No-Build queues generated by two congestion points (Callahan Tunnel off-ramp and Haymarket Square on-ramp) will be reduced under Alternative 2



Typical Extent of Queue

Ⓕ Level of Service at Congestion Point

Figure 31

Alternative 2—1990, 2010—Central Artery/Southeast Expressway, Congestion Points and Queues

Diagrams not to scale

EIS/EIR for I-90, The Third Harbor Tunnel

conditions. The former queue will extend back to the Causeway Street on-ramp, as compared to the No-Build queue which extends beyond this ramp. The latter queue will extend to the Callahan Tunnel exit as compared to the No-Build queue, which will extend to the Storrow Drive off-ramp. Queues on Interstate 93 and the Mystic-Tobin Bridge, which are generated at the Charlestown High-Level Bridge, will be shorter than those occurring under the No-Build Alternative. The Alternative 2 queue length on Interstate 93 will be 1-1/4 miles and 7/8 mile on the Mystic Bridge. In addition to these queues, Alternative 2 will create two new Central Artery queues: 1) higher traffic volumes on the southbound Storrow Drive on-ramp will create side friction for Central Artery traffic, creating a queue which extends beyond the Mystic-Tobin Bridge on-ramp to the Artery, and 2) a queue will develop in the Dewey Square Tunnel (local roadway access), due to friction at the Summer Street off-ramp, extending to the merge with the Third Harbor Tunnel traffic. This queue will not affect the through-traffic roadway of the Dewey Square Tunnel.

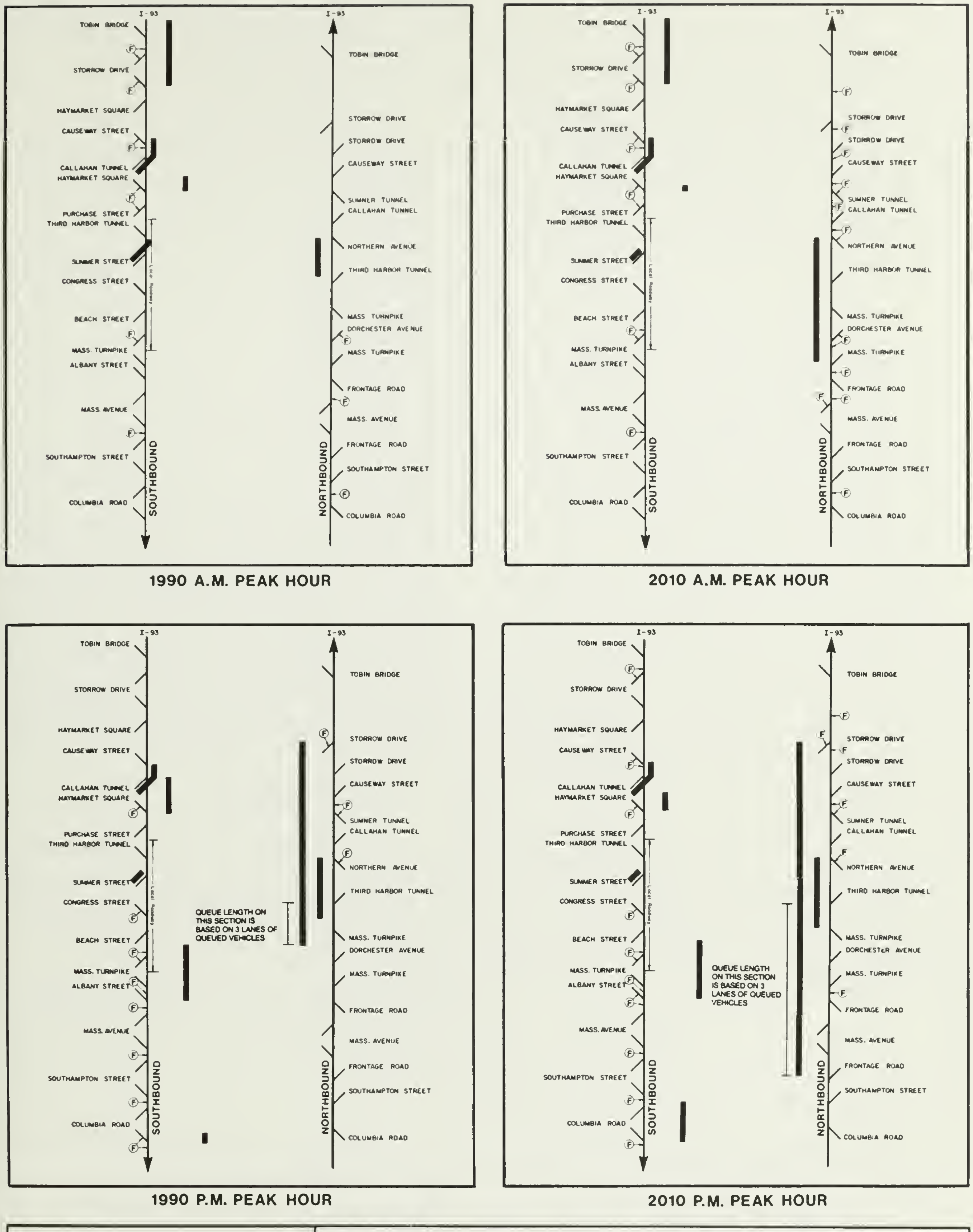
During the PM peak hour, the No-Build queues at the northbound Callahan Tunnel off-ramp and the East Berkeley Street on-ramp will be eliminated under Alternative 2, although two other No-Build queues will still occur under Alternative 2. The queue generated by the northbound bottleneck on the approach to the High-Level Bridge will extend back to the Massachusetts Avenue Interchange. This queue length is based on three lanes of queued vehicles, when, in fact, four to five travel lanes will be available for use in the Fort Point Channel Tunnel and southerly on the Expressway approach to the tunnel. The remaining lanes are assumed to be predominantly occupied by Tunnel and on- and off-ramp traffic. The Northern Avenue on-ramp merge area will also create a queue on the Artery which will extend into the Fort Point Channel tunnel just beyond the cross-harbor tunnel diverge. Southbound, Alternative 2 will reduce (but not eliminate) the queues generated by the Callahan Tunnel off-ramp and Haymarket Square on-ramp. Queues at the Summer Street off-ramp, the Albany Street on-ramp, and the Columbia Road on-ramp will also remain with Alternative 2.

Year 2010. In the AM peak hour, most northbound and southbound queues will be the same as those presented for 1990. However, increased traffic on the Central Artery and the Northern Avenue on-ramp will create a queue at this merge area, extending to the cross-harbor tunnel diverge. In addition, queues on Interstate 93 and the Mystic-Tobin Bridge will extend back, from the congested High-Level Bridge, 3-1/2 and 1-1/2 miles, on the respective roadways.

In the PM peak, the queue generated by the northbound bottleneck on the approach to the High-Level Bridge will extend into the new Fort Point Channel tunnel, reaching the Massachusetts Avenue on-ramp. This length is based on three lanes of queued vehicles; therefore two lanes will be available in the Fort Point Channel Tunnel to service on- and off-ramp traffic. Southbound, queues will be similar to those of 1990.

Alternative 3

Year 1990. On the northbound Central Artery during the AM peak (Figure 32), implementation of Alternative 3 will essentially eliminate those queues expected under the No-Build Alternative, with one exception: a queue, generated at the merge area where the Northern Avenue on-ramp enters the Artery, will extend into the new three-lane northbound Central Artery roadway; however, it will not extend into the Fort Point Channel tunnel. In the southbound direction, the No-Build Alternative queue generated at the Haymarket Square on-ramp merge area will be significantly reduced by Alternative 3, whereas the queue extending from the Callahan Tunnel off-ramp onto the Central Artery will remain unchanged.



Typical Extent of Queue

Ⓕ Level of Service at Congestion Point

Figure 32

Alternative 3—1990, 2010—Central Artery/Southeast Expressway, Congestion Points and Queues

Diagrams not to scale

EIS/EIR for I-90, The Third Harbor Tunnel

A new queue will be generated at the merge area where Storrow Drive traffic enters the southbound Central Artery, extending back onto Interstate Route 93. In addition, southbound queues on Interstate 93 and the Mystic-Tobin Bridge will be generated at the High-Level Bridge and will extend back nearly 1-1/2 miles on Interstate 93, and nearly 7/8 mile on the connecting ramp from the Mystic-Tobin Bridge.

During the PM peak hour, queues on the northbound Central Artery at the bottleneck section approaching the High-Level Bridge and at the Northern Avenue on-ramp merge area will be shorter under Alternative 3 than those with the No-Build Alternative. The High-Level Bridge queue will extend, in three lanes, into the five lane Fort Point Channel Tunnel. Assuming segregation of traffic into appropriate lanes, access to the Third Harbor Tunnel should not be severely impaired. The improvement in operation in the Callahan Tunnel will eliminate the No-Build Alternative queue which extends onto the off-ramp and the Central Artery. Finally, the queue at East Berkeley Street/Central Artery merge area will be eliminated since this ramp will be discontinued with Alternative 3.

Southbound in the PM peak hour, the length of queues on the Central Artery generated at the Columbia Road on-ramp, Albany Street on-ramp, Haymarket Square on-ramp and Callahan Tunnel off-ramp will be reduced under Alternative 3.

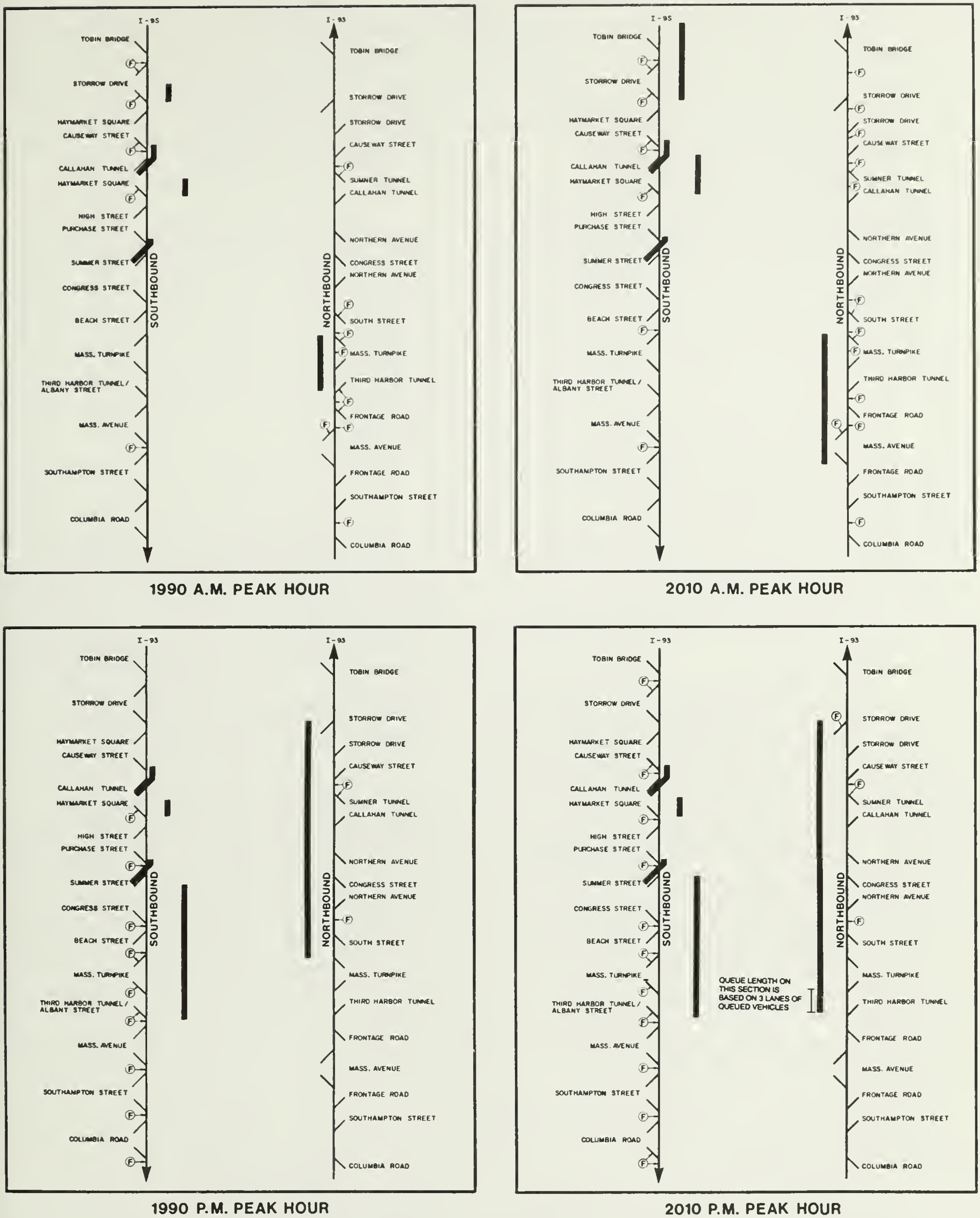
<u>Year 2010.</u> In the AM peak hour, northbound and southbound queues will be generally the same as those shown for year 1990 for Alternative 3, except increased traffic on the Artery and the Northern Avenue on-ramp will result in a queue generated at this merge area extending into the five-lane Fort Point Channel tunnel to the Massachusetts Turnpike off-ramp. This queue will cause delays and potential queuing effects on East Boston-bound tunnel traffic in this five-lane weave section. In addition, southbound queues on I-93 and the Mystic-Tobin Bridge will increase to lengths of three miles and 1-3/4 miles, respectively.

In the PM peak, the queue generated at the northbound bottleneck approaching the High-Level Bridge will extend into the Fort Point Channel tunnel, beyond the Massachusetts Avenue interchange. Since the Artery is four or five lanes wide along this section, and the above queue length is based on three lanes of queued vehicles, one or two lanes will remain available to on- and off-ramp traffic. A queue generated at the merge area, where Northern Avenue traffic enters the Central Artery, will also extend to the Massachusetts Turnpike on-ramp. During the AM, these two northbound queues will cause delays and potential queuing effects on East Boston-bound tunnel traffic. Southbound queues in the PM peak hour will be of similar length as in 1990, except at the Columbia Road on-ramp merge with Southeast Expressway traffic. With higher volumes than for 1990 on the ramp and the Southeast Expressway, the queue will be somewhat longer and will extend beyond the Columbia Road off-ramp.

Alternative 4

<u>Year 1990.</u> On the northbound Central Artery during the AM peak hour (Figure 33), Alternative 4 will reduce or eliminate those queues expected under the No-Build Alternative, with the exception of a queue where Massachusetts Turnpike traffic enters the northbound Central Artery. This queue will extend from the merge area to beyond the Central Artery's off-ramp to the Turnpike westbound.

In the southbound direction, the queue from the Haymarket Square on-ramp merge with the Central Artery will be significantly reduced by Alternative 4, due primarily to lower traffic volumes on the Haymarket on-ramp. The queue at the Callahan Tunnel off-ramp, extending to the Causeway Street on-ramp, will be marginally shorter than with the No-Build Alternative. The queue at



Typical Extent of Queue

Ⓕ Level of Service at Congestion Point

Figure 33

Alternative 4—1990, 2010—Central Artery/Southeast Expressway, Congestion Points and Queues

Diagrams not to scale

EIS/EIR for I-90, The Third Harbor Tunnel

the Summer Street off-ramp will extend beyond Purchase Street. This queue is longer than the No-Build conditions because heavier volumes of traffic will exist on some approaches to the Summer Street/Purchase Street intersection. A queue will be generated at the Storrow Drive merge with the southbound Central Artery. This queue will be short and will not affect the southbound exit to Storrow Drive. On Interstate 93 and the Mystic-Tobin Bridge, queues emanating from the High-Level Bridge will extend back nearly 1-3/4 miles on I-93 and nearly one mile on the Mystic Bridge.

During the PM peak hour, three out of four isolated queues generated under the No-Build Alternative in the northbound direction will be eliminated by Alternative 4. Only the queue generated at the bottleneck section on the approach to the High-Level Bridge will remain, extending back to the Massachusetts Turnpike on-ramp.

In the southbound direction, the Albany Street/Third Harbor Tunnel on-ramp will create side-friction turbulence for southbound traffic, generating a queue at this merge area extending into the Dewey Square Tunnel, nearly to the Summer Street off-ramp. Under No-Build conditions, this queue would be shorter because of the reduced traffic. Two other southbound queues, at the Haymarket Square on-ramp merge area and at the Callahan Tunnel off-ramp, will be reduced under Alternative 4, as compared to No-Build conditions. Finally, increased traffic on some surface street approaches to the Summer Street/Purchase Street intersection will generate a queue at the Summer Street exit, extending onto the Central Artery.

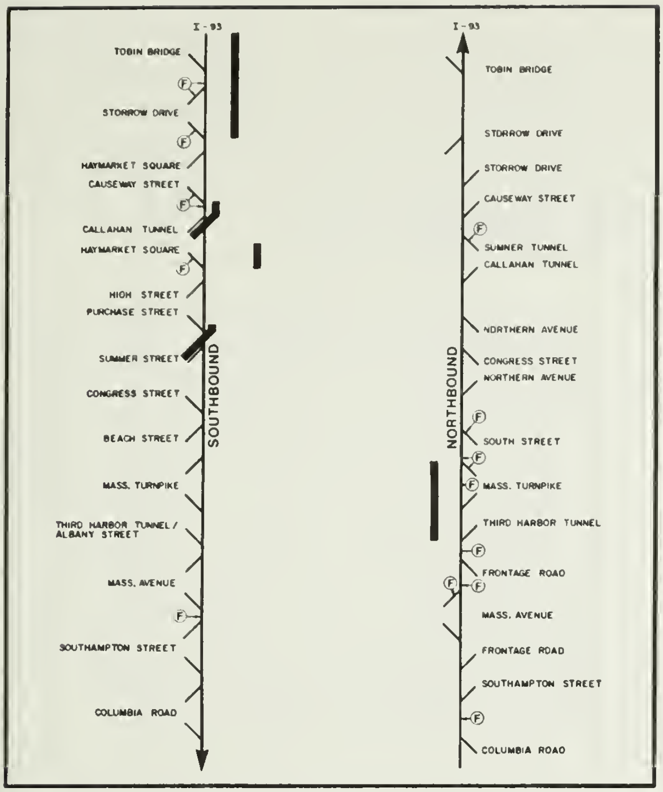
Year 2010. Increased traffic by 2010 will lengthen the 1990 queues during the AM peak, both northbound and southbound on the Central Artery, particularly at the northbound Massachusetts Turnpike on-ramp merge area, where the queue will extend to the Frontage Road on-ramp. In addition, the southbound queue at the Storrow Drive on-ramp merge area will extend onto Interstate 93. Southbound queues emanating from the High-Level Bridge will extend back more than 3-1/4 miles on Interstate 93 and 1-3/4 miles on the Mystic-Tobin Bridge.

During the PM peak hour, northbound and southbound queues will be similar to those for 1990. Only the queue at the northbound two-lane bottleneck section approaching the High-Level Bridge will increase significantly from 1990 to 2010, by which time it will extend all the way back to the Third Harbor Tunnel off-ramp.

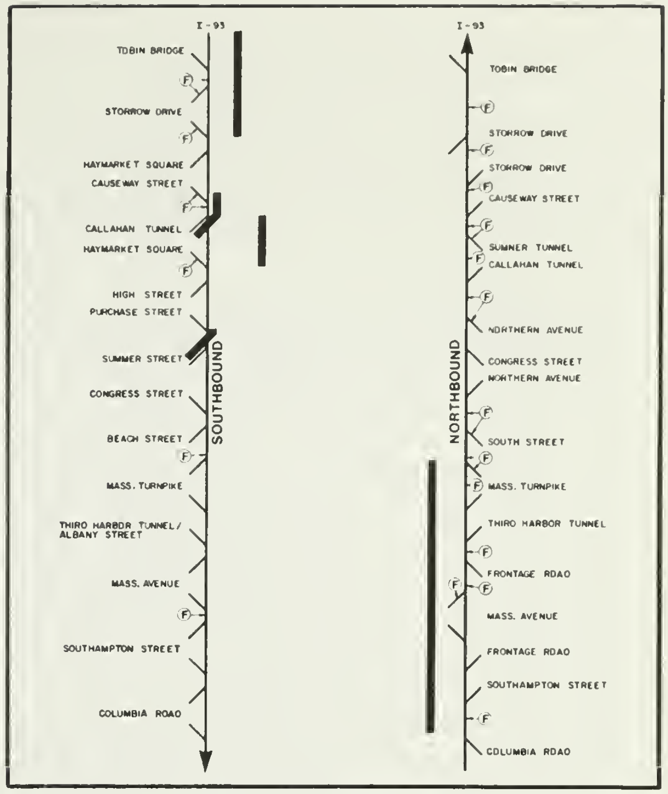
Alternative 5

Year 1990. On the northbound Central Artery during the AM peak (Figure 34), two isolated queues expected with the No-Build Alternative will be eliminated, and one will be reduced, with Alternative 5. The remaining queue, at the Massachusetts Turnpike merge with the Central Artery, will extend nearly to the Third Harbor Tunnel off-ramp.

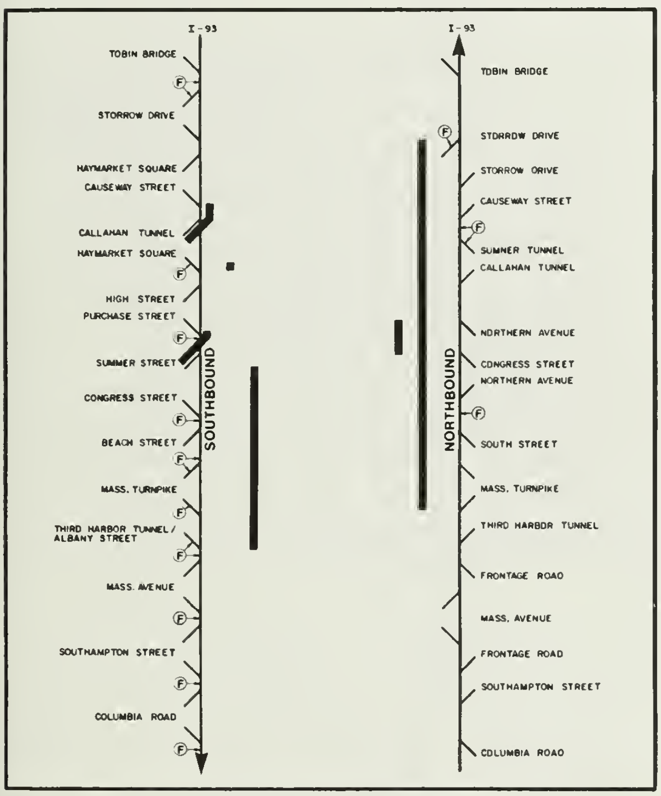
In the southbound direction, two queues will be substantially reduced, one will be increased, and a new queue will result with Alternative 5. A queue from the Haymarket Square on-ramp merge area will extend half-way back to the Callahan Tunnel off-ramp gore. This compares with a No-Build Alternative queue which would extend to the Storrow Drive off-ramp. A queue from the Callahan Tunnel off-ramp will extend to the Causeway Street on-ramp with this alternative. With the No-Build Alternative, this queue would extend beyond the Causeway Street on-ramp, approximately half-way to the Haymarket Square off-ramp. The Summer Street off-ramp will create a queue extending onto the Central Artery, past the Purchase Street on-ramp. This queue is longer than that estimated for the No-Build Alternative, because of higher traffic volumes on some approaches to the Purchase Street/Summer Street intersection. A new queue will be



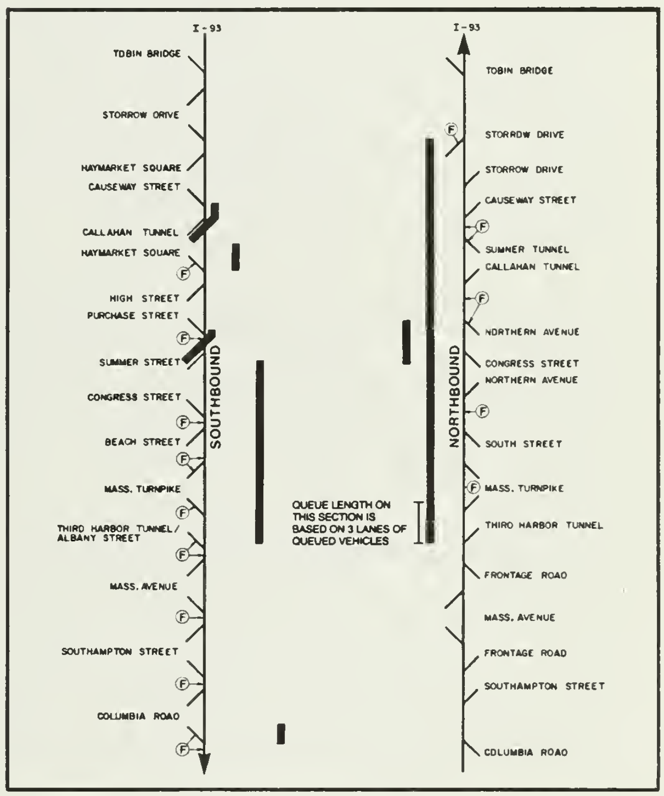
1990 A.M. PEAK HOUR



2010 A.M. PEAK HOUR



1990 P.M. PEAK HOUR



2010 P.M. PEAK HOUR

▬ Typical Extent of Queue Ⓕ Level of Service at Congestion Point	Figure 34 **Alternative 5 — 1990, 2010 — Central Artery/Southeast Expressway, Congestion Points and Queues**
	Diagrams not to scale EIS/EIR for I-90, The Third Harbor Tunnel

created at the Storrow Drive on-ramp merge area extending back onto Interstate 93. Queues generated at the High-Level Bridge will extend nearly 1-1/2 miles on Interstate 93 and about one mile on the Mystic-Tobin Bridge.

During the PM peak hour, Alternative 5 will eliminate two out of four isolated queues generated under the No-Build Alternative in the northbound direction. The queue onto the Central Artery from the Callahan Tunnel off-ramp will be eliminated because lower traffic volumes in the tunnel and its approaching roadways will allow a less congested entry to the tunnel. The queue at the East Berkeley Street on-ramp merge area will be eliminated by the discontinuance of this ramp. The queue generated at the Northern Avenue on-ramp merge area will be reduced such that it extends only back to the Congress Street on-ramp, as compared to the Massachusetts Turnpike on-ramp with the No-Build Alternative. The queue at the High-Level Bridge will be shorter than under the No-Build Alternative, extending back through the Dewey Square Tunnel to the Massachusetts Turnpike off-ramp.

Southbound, the queue at the Columbia Road on-ramp merge area will be eliminated by Alternative 5, while that at the Haymarket Square on-ramp merge area and from the Callahan Tunnel off-ramp will be reduced. Heavy traffic on the Albany Street/Third Harbor Tunnel on-ramp, creating additional side-friction, will result in a queue extending back into the Dewey Square Tunnel, nearly to the Summer Street off-ramp. The queue generated from the Summer Street ramp will be somewhat larger than that which would result under the No-Build Alternative.

Year 2010. During the AM peak hour, northbound and southbound queues on the Central Artery will occur at the same locations indicated for 1990. The lengths of these queues will also be similar, except for the Massachusetts Turnpike northbound on-ramp merge area, which will extend back to the Columbia Road on-ramp. Southbound, queues generated at the High-Level Bridge will extend back nearly three miles on Interstate 93 and nearly two miles on the Mystic-Tobin Bridge.

During the PM peak hour, northbound and southbound queues under year 2010 traffic loadings will be similar to those indicated for year 1990. The northbound bottleneck queue on the Central Artery will be somewhat longer in 2010 and will extend back to the Third Harbor Tunnel off-ramp. Southbound, higher traffic volumes on the Columbia Road on-ramp and on the Southeast Expressway itself will generate a queue from this merge area extending half-way back to the Columbia Road off-ramp.

4.2.4 Vehicle Miles and Vehicle Hours Travelled

Vehicle miles of travel is a measure of total distance travelled by all vehicles on a study area roadway system. Similarly vehicle hours of travel is a measure of the total travel times expended by these same (all) vehicles on the same roadway system. They are used as indicators of the effectiveness of roadway improvements in providing transportation benefits to motorists (in terms of savings in travel distance or time and related travel costs) and secondary environmental benefits to the general population (reduced energy consumption, air pollution, etc.).

Projected vehicle miles and vehicle hours of travel for the No-Build Alternative and the build alternatives are summarized in Tables 29 and 30. Vehicle miles and vehicle hours are reported on both a daily and an annual vehicle basis for year 2010. These projections are for the geographical area roadway system affected by the project, which includes the area encompassing all of Boston, plus the surrounding communities of Chelsea, Everett, Somerville, Cambridge, and Brookline.

Table 29

YEAR 2010 VEHICLE MILES OF TRAVEL[1]

Alternative	Daily	Differences vs. Alt. 1	Yearly	Differences vs. Alt. 1
1	9,740,000	-	3,301,860,000	-
2	9,793,400	53,400	3,319,963,000	18,103,000
3	9,796,300	56,300	3,320,946,000	19,086,000
4	9,794,400	54,400	3,320,302,000	18,442,000
5	9,820,000	80,000	3,328,980,000	27,120,000

Table 30

YEAR 2010 VEHICLE HOURS OF TRAVEL[1]

Alternative	Daily	Differences vs. Alt. 1	Yearly	Differences vs. Alt. 1
1	439,500	-	148,991,000	-
2	439,300	200	148,923,000	68,000
3	439,100	400	148,885,000	136,000
4	435,400	4100	147,601,000	1,322,000
5	431,800	7700	146,380,000	2,611,000

1 Based on roadway network within Boston, Chelsea, Everett, Somerville, Cambridge, and Brookline.

It was not possible to isolate the expressway and local roadway sections upon which the vehicle-mile and -hour changes were concentrated.

From Table 29, the No-Build Alternative has the lowest total of vehicle miles travelled, at 9.74 million vehicle miles daily. This is not unexpected, as the four build alternatives induce approximately 12,800 additional vehicle trips daily on this roadway system. A secondary factor is that alternative routes for some diverted traffic of the build alternatives, although faster because of diversions from local arterial streets to express highway sections, are longer in distance than the No-Build Alternative.

However, for all build alternatives, vehicle miles travelled increases are less than one percent of the No-Build Alternative on a systemwide basis, and reflect the fact that the project has less of a regional network influence and more of a local influence for which it was intended: increased cross-harbor capacity between Boston and East Boston and congestion relief on existing cross-harbor facilities and portions of the Central Artery. Alternative 2 effects the least vehicle-miles increase of all build alternatives, followed by Alternative 4. Both alternatives follow the railroad alignment to East Boston, which is shorter than the airport alignments of Alternatives 3 and 5. Alternative 5 results in the highest vehicle miles travelled of all build alternatives. For the comparable East Boston alignment, the two-way alignment on the Boston side results in higher vehicle miles travelled than the split alignment (railroad: Alternative 4 versus 2; airport: Alternative 5 versus 3).

In contrast to vehicle miles of travel, all build alternatives will decrease total systemwide vehicle hours of travel in comparison to the No-Build Alternative, with Alternative 2 effecting the least savings in vehicle-hours travelled (200 vehicle-hours daily) in 2010. This savings is considerably less than one percent systemwide, again reflecting the fact that the proposed project is more localized than systemwide. In terms of vehicle hours of travel time savings, the significance of the Central Artery improvements on the Boston side far outweighs the significance of the East Boston side improvements; Alternatives 4 and 5 (two-way alignments on the Boston side) effect almost 20 times the travel time savings than Alternatives 2 and 3 (split alignments on the Boston side). However, for a given Boston side alignment, the airport alignment in East Boston is considerably more effective (by almost double) in achieving greater travel time savings than the railroad alignment. The travel time savings differences between the split and two-way alignments are attributable to the more pronounced queuing and congestion effects of the northbound Artery on the split alignment, with backups from both the High-Level Bridge and Northern Avenue occurring into the five-lane Fort Point Channel tunnel, affecting harbor-crossing traffic. The differences between the railroad and airport alignments reflect the slightly higher volumes and consequently reduced travel speeds on the former alignment.

4.2.5 Safety

Accident Potential

Highway System

Table 31 summarizes predicted yearly accidents along the Central Artery/Southeast Expressway, including approaches to the existing and Third Harbor tunnels, and to the existing and proposed tunnel approaches in East Boston for all five alternatives. Included in the build alternative tabulations are estimates of future accidents within the Third Harbor Tunnel itself. Also included, for comparison purposes, is the average annual rate of accidents occurring in

Table 31

FUTURE REGIONAL HIGHWAY SYSTEM ACCIDENT SUMMARY

	Average Existing	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	1978-1980	1990	2010	1990	2010	1990	2010	1990	2010	1990	2010
Central Artery											
Section 1*	381	454	470	414	452	395	423	410	456	403	445
Section 2*	235	260	284	135	156	149	175	137	155	150	174
Section 3*	197	201	232	153	169	152	164	158	170	158	171
Section 4*	200	203	206	199**	217**	184**	200**	187**	203**	208**	224**
Subtotal	1013	1118	1192	901	994	880	962	892	984	919	1014
East Boston											
Tunnel Approaches	159	164	226	189**	251**	101**	127**	188**	242**	102**	125**
TOTAL	1172	1282	1418	1090	1245	981	1089	1080	1226	1021	1139

* Section 1: Rte I-93/Rte 1 to Causeway St.
Section 2: South of Causeway St. to Callahan/Sumner Tunnels.
Section 3: South of Tunnels to Beach St.
Section 4: Kneeland St. to Southampton St.

** Includes estimated future accidents on Third Harbor Tunnel roadways and approaches.

the network for 1978-1980.

Discussions of existing accident history on these major highway sections, as well as predicted 1990 and 2010 accident potential without the project (No-Build Alternative) are contained in Section 3.1.2. In summary, total accidents on the major highway sections are estimated to increase over present levels by 9 percent and 21 percent, respectively for 1990 and 2010. These increases will result from increased traffic on the base network during these periods.

All four build alternatives will reduce accident potential on the regional highway system in 1990 and 2010 in comparison to the No-Build Alternative, as follows:

Regional Highway System Accident Reduction

Alternative	1990	2010
2	15%	12%
3	23%	23%
4	16%	14%
5	20%	20%

Alternatives 3 and 5 will effect the greatest accident reductions, 20-23 percent during both periods, followed by Alternative 4; Alternative 2 will effect the least reductions. Alternatives 3 and 5 are common on the East Boston side, indicating the increased effectiveness of the airport alignments in reducing major highway accident potential over the railroad alignments, by almost one-half, in East Boston.

The railroad alignment alternatives (Alternatives 2 and 4) are less effective because they have a more complex interchange system with Route 1A and the airport access/egress roads. The tunnel portals, toll plaza and approach ramps are also located closer to the existing tunnel system. These factors result in increased vehicle conflicts due to the greater number of decision points (merge, weave, and diverge movements) between the railroad alternatives and the existing tunnels. Secondly, Logan Airport traffic bound from and to Boston must negotiate the Route 1A airport access/egress road system interchange, while airport traffic utilizing the airport alignment will not. Thirdly, due to these factors and the more direct connections which the railroad alignment alternatives effect with Route 1A as compared to the airport alignment alternatives, overall traffic volumes are higher on the railroad alignment alternatives.

On the Central Artery, the differences in accident potential between the four build alternatives vary by five percent or less and do not appear to be influenced by the optional two-way or split alignments.

All four build alternatives will reduce regional highway system accident potential in 1990 to below existing levels; the airport alignment alternatives (3 and 5) will remain below existing levels in 2010.

Local Roadway System

Projections of future accident potential at local intersections in South Boston and East Boston are summarized in Table 32 for all five alternatives. Also included, for comparison purposes, are existing accidents (1978-1980 average).

Discussions of existing accident history and predicted accident potential for 1990 and 2010 without the project (No-Build Alternative) were also contained in Section 3.1.2. In summary, total annual accidents at the selected intersections in South Boston will increase by 17 percent and 24 percent in 1990 and 2010, respectively, with the No-Build Alternative. Increases are due to predicted regional traffic growth, with spillovers into South Boston, and new traffic generated by major commercial and industrial developments proposed in the northern section of South Boston. At the selected intersections, accident increases are predicted to range from

Table 32

FUTURE LOCAL ROADWAY SYSTEM ACCIDENT SUMMARY

	Average Existing	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	1978-1980	1990	2010	1990	2010	1990	2010	1990	2010	1990	2010
South Boston											
Columbia Road/ Old Colony Ave./ Day Blvd.	11	14	15	14	14	14	14	14	14	14	14
Andrew Square	8	11	12	11	12	11	12	11	12	11	12
Columbia Road/ Day Blvd./L St.	5	5	5	5	5	5	5	5	5	5	5
L St./Summer St./ E. First St.	7	9	9	9	9	9	9	8	9	8	9
Dorchester Ave./ W. Broadway	9	9	10	13	14	13	14	14	14	14	14
Summer St./D St.	10	10	10	10	11	10	11	11	11	11	11
Dorchester Ave./ W. Fifth St./A St.	10	9	10	8	10	8	10	9	10	9	10
Dorchester Ave./ W. Fourth St.	10	10	10	9	10	9	10	10	9	10	9
Congress St./A St.	4	6	7	6	6	6	6	6	7	6	7
Northern Ave./ Sleeper St.	8	13	14	12	13	12	13	13	14	13	14
SUBTOTAL	82	96	102	97	104	97	104	101	105	101	105
East Boston											
Condor St./ Meridian St.	13	13	14	16	17	16	17	16	17	16	17
Bennington St./ Bremen St.	7	7	8	7	7	7	8	7	7	7	8
Bennington St./ Chelsea St.	23	24	25	24	25	24	25	24	25	24	25
Meridian St./ Bennington St.	13	14	15	14	14	14	15	14	14	14	15
Porter St./4Cottage St.	2	3	3	1	3	3	2	1	3	3	2
SUBTOTAL	58	61	65	62	66	64	67	62	66	64	67
TOTAL	140	157	167	159	170	161	171	163	171	165	170

no increase to as many as six accidents yearly (75 percent increase) by 2010. In East Boston, yearly accidents are predicted to increase slightly by 1990 and then continue to increase until 2010. Again, this increase in accidents results from the regional traffic growth. For the selected intersections in South Boston and East Boston combined, accident potential without the project (No-Build Alternative) will increase 12 percent by 1990 and 19 percent by 2010.

All four build alternatives will have negligible effects on accident potential on local South Boston and East Boston streets in 1990 and 2010. On an intersection-by-intersection basis, most intersections will experience the same, or even decreased, accident hazard for the various build alternatives in comparison to the No-Build Alternative. Only one selected intersection in each area is predicted to have accident increases under the various build alternatives:

- o South Boston: Dorchester Avenue/West Broadway (4 to 5 accidents yearly; approximately 50 percent higher).

- o East Boston: Condor Street/ Meridian Street (3 accidents yearly; approximately 20 percent higher).

As a result, total estimated accidents in 1990 and 2010 on selected local roadways in both areas under the four build alternatives will be slightly higher (by five percent or less) than the No-Build Alternative.

Regional Highways and Local Roadways Combined. Combining the accident potential estimates for selected regional highway and local roadway sections contained in Tables 31 and 32 results in the following reductions in accident potential for the four build alternatives in comparison to the No-Build Alternative:

Combined Regional Highway and Local Accident Reduction

Alternative	1990	2010
2	13%	11%
3	20%	21%
4	14%	12%
5	18%	17%

Alternative 3 will be most effective in reducing accident potential, at 20-21 percent, and Alternative 2 least effective at 11-13 percent, in 1990 and 2010. The regional highway influence outweighs the local roadway influence with regard to accident potential, as indicated in Tables 31 and 32 and the previous discussions; the greatest difference in accident potential is effected by the airport alignments (3 and 5) in comparison to the railroad alignments (2 and 4) in East Boston.

Emergency Vehicle Access

Access for fire, police, ambulance, and other emergency vehicles between Boston and East Boston will not change under the No-Build Alternative. In the event that the Callahan/Sumner tunnels are jammed, emergency ground access between Boston and East Boston will only be possible via local routes and Chelsea Creek crossings between Charlestown and Chelsea and East Boston or via routes through East Boston's northern neighboring communities.

All four build alternatives will improve emergency service provisions across Boston Harbor between Boston and East Boston. Emergency vehicle response times will decrease with the Third Harbor Tunnel. These more rapid response times will prove especially critical in the event of an airport-related emergency.

The existence of a Third Harbor Tunnel will of itself be beneficial to

emergency vehicles if only because it provides a direct alternative route to the existing tunnels, in the event that one or both of the existing tunnels should be temporarily blocked due to an accident or other reasons, rather than having to rely on more circuitous routes utilizing the Mystic-Tobin Bridge or local East Boston to Chelsea to Charlestown crossings.

Hazardous Cargoes

Hazardous cargo routes will remain unchanged with the No-Build Alternative in 1990 and 2010, with the same restrictions and physical limitations still applying to the Callahan/Sumner Tunnels and the Dewey Square Tunnel on the Central Artery.

In the future, with any of the build alternatives, hazardous cargo vehicle routes through downtown Boston should also remain essentially unchanged. The only differences will be that for Alternatives 2 and 3, the split alignments, the High Street off-ramp southbound will be replaced by a new off-ramp directly onto Purchase Street. Similarly, northbound, the Congress Street on-ramp will no longer exist, requiring hazardous cargo vehicles to travel further north along Atlantic Avenue to Northern Avenue, where an on-ramp to the Central Artery northbound will be provided.

Hazardous cargo vehicles will be prohibited from using the Third Harbor Tunnel itself and, in the case of Alternatives 2 and 3, the new Fort Point Channel portion of the northbound Central Artery.

The creation of a new Dorchester Avenue open to all vehicles between West Broadway in South Boston and Northern Avenue presents the opportunity for an alternative routing of hazardous cargo vehicles through downtown Boston, especially in the northbound direction. Such vehicles can gain access to Dorchester Avenue via the West Fourth Street or Broadway Bridges. Once at Northern Avenue or Congress Steet, they can rejoin the northbound Central Artery. Direct access to new Dorchester Avenue from the northbound Expressway/Artery by hazardous cargo vehicles would be prohibited under any build alternative because of the ramp's approximate 1000-foot long tunnel section.

4.2.6 Other Transportation Facilities

Logan Airport

As indicated in previous subsections, connections between Boston and the airport will become increasingly more difficult between 1982 and 2010 under the No-Build Alternative because of the increased traffic and congestion along the Central Artery approaches to the existing tunnels, the tunnels themselves, the Route 1A ramps between the tunnels and the airport access/egress roadway system, and the airport roadway system itself. LOS F conditions will prevail with longer queues occurring at the tunnel approaches during the peak hours. LOS E or F operations within the Callahan/Sumner Tunnels will increase from 5 hours per day in 1982 to 14 hours per day in 2010, practically from 6 AM to 8 PM. Much of this increased traffic congestion will be due to airport traffic, despite the fact that airport transit usage will increase as a result of the increased congestion.

The major positive impact of the build alternatives on Logan Airport will be to improve traffic circulation and access to the airport, due to the alternative routing provided and the reduced congestion in the existing tunnels and on the Mystic-Tobin Bridge. On Route 1A north of the airport, even with the predicted increased traffic, travel times should increase only slightly because LOS A operation will be maintained in the AM peak, and will increase only from LOS B to C operation in the PM peak, as compared to the No-Build Alternative, all levels representing free to stable flow conditions with minimum to no

delays. Bell Circle will remain at LOS F operation under all alternatives.

The build alternatives will add approximately 12,800 vehicle trips per day to the airport roadway system. As previously indicated, these additional vehicle trips represent air passenger, visitor and employee diversions from public transportation modes or higher occupancy vehicles (i.e. taxis, shuttles, and limousines). The effects of this roadway system and ramp approaches from the tunnels and Route 1A were discussed previously. For Alternatives 2 and 4, the railroad alignments in East Boston, the major congestion will be at the Airport Crossover Road intersections, where LOS will increase from E to F (above capacity operation). Travel time savings and congestion between Boston and the airport under Alternatives 3 and 5 will be somewhat more improved for traffic bound from the south-southeast of Boston, because of the more direct airport connection.

Within the airport, traffic conditions will remain relatively unchanged for Alternatives 2 and 4 in comparison to the No-Build Alternative. For Alternatives 3 and 5, however, traffic conditions within the airport will generally be improved.

Alternatives 3 and 5 provide a more direct connection into the passenger terminal area of the airport than either the No-Build Alternative or Alternatives 2 and 3, thus avoiding the necessity of traffic bound for the terminal area to pass through the signalized intersections. Motorists continuing to enter or leave the airport via Route 1A will experience reduced travel times and less congestion due to the reduced traffic flows on the main airport roadway to the west of the terminal area.

Alternatives 3 and 5 also provide a new southbound connection between the north service area and the Bird Island Flats area of the airport. This connection will reduce traffic on the Airport Crossover Road and will present the opportunity for changes to the traffic signal timing sequences on this road to favor the airport's main access road. However, this new connecting service road, which also connects with Porter Street, will encourage vehicles bound from the north service area to the Sumner Tunnel to use Porter Street, since the Sumner Tunnel can only be reached otherwise via Prescott Street and Neptune Road, or by a circuitous on-airport route.

Public Transportation

In the long term, the No-Build Alternative should increase demands on cross-harbor and airport-related public transportation services. As indicated previously, these demands will increase because of increased demand for total cross-harbor, and in particular, airport travel, which will not be able to be entirely met by the roadway network on both sides of the harbor. By 2010, cross-harbor Blue Line, bus, taxi and limousine services will, at minimum, be serving an additional demand amounting to an equivalent of 12,800 airport-related vehicle trips which will be unmet by the No-Build Alternative.

The build alternatives will prevent the potential 12,800 vehicle-trip diversions of airline passengers and employees from the highway modes to public transportation or higher occupancy vehicle modes, because of improved airport access at lower congestion levels. Therefore, demands on airport-related transit services will be less under the build alternatives than under the No-Build Alternative. The build alternatives' effects on ridership of non-airport-oriented transit trips, especially on local services in and between downtown Boston, South Boston, and East Boston should be minor, because airport traffic and Boston area through traffic constitute the majority of Third Harbor Tunnel trips.

All build alternatives, however, will have beneficial effects on the provision of highway vehicle transit services (i.e. buses, taxis,

limousines) because of the improved access to East Boston, Logan Airport, and the North Shore, and the reduced traffic congestion on alternative routes due to diversions to the new tunnel. The chief beneficiaries will be transit services utilizing the existing Callahan/Sumner Tunnels, the Mystic-Tobin Bridge, and the Central Artery south of the Tunnels. Since many of the MBTA's express buses to and from the North Shore utilize the Callahan and Sumner Tunnels, their schedules should improve through this area. However, traffic on the Massachusetts Turnpike with Boston destinations may experience slight increases in travel times, due to the diverted traffic occasioned by the direct connection to the Third Harbor Tunnel.

Long-term impacts of the build alternatives on the many MBTA local bus routes within the study area are expected to be negligible since their routes should remain essentially unaffected by the Third Harbor Tunnel in the long term.

The differences between the build alternatives relative to their effects on public transportation will be minor, and limited to the following:

(1) On the Boston side, longer delays may be experienced by transit vehicles utilizing the Third Harbor Tunnel northbound during peak hours under the split alignment alternatives (2 and 3) because of Central Artery northbound queuing occurring through the common five-lane Fort Point Channel Tunnel than under the two-way alignment alternatives (4 and 5).

(2) On the East Boston side, airport-related transit services will be enhanced more under Alternatives 3 and 5 (airport alignments) because of the more direct tunnel connections to the airport than under Alternatives 2 and 4 (railroad alignments).

4.2.7 Construction Impacts

Based on preliminary construction schedules for the four build alternatives, twelve critical time periods were selected for analysis. All alternatives commence construction in September 1986, and assume no difficulties with labor availability, materials, etc. The time periods analyzed were as follows:

o Alternatives 2 and 3: Boston Split Alignment
(1) January 1987 (AM)
(2) July 1987 (PM)
(3) February 1989 (PM)
(4) December 1989 (PM)

o Alternatives 4 and 5: Boston Two-Way Alignment
(5) June 1987 (AM)
(6) December 1987 (PM)
(7) July 1989 (PM)

o Alternatives 2 and 4: East Boston Railroad Alignment
(8) December 1987 (PM)
(9) January 1988 (AM)
(10) February 1989 (PM)
(11) July 1989 (PM)

o Alternatives 3 and 5: East Boston Airport Alignment
(12) February 1990 (PM)

The analyses were based on traffic assignments which reflect changes in the roadway network due to Third Harbor Tunnel construction. These changes typically consist of the removal of links from the network (roadways temporarily out of service), changes in capacities and/or speeds on certain links (reflecting reduced roadway or bridge widths during construction), or additions to the network (representing either new temporary or permanent roadways).

Although all construction is expected to commence in 1986, No-Build 1990 traffic volumes were used as the "worst case" construction year traffic for all assignments.

The results of these analyses indicate that construction period traffic impacts will largely be confined to three corridors:

(1) South Bay/Fort Point Channel

bridge crossing corridor under all build alternatives.

(2) Central Artery/Surface Artery corridor, north of Dewey Square, for Alternatives 2 and 3 (split alignments).

(3) East Boston Railroad Right-of-Way Corridor for Alternatives 2 and 4 (railroad alignments).

The findings with regard to construction period traffic impacts are summarized here by corridor.

<u>South Bay/Fort Point Channel Crossings</u>

Construction staging calls for alternate closing of the West Fourth Street and Broadway Bridges in South Bay and the Summer and Congress Street Bridges in Fort Point Channel during construction. At all times during construction in these two areas at least one bridge will remain open to traffic, although there may be width (capacity) restrictions. In Fort Point Channel, the new Northern Avenue Bridge will remain open at all times, provisions having been made in its design for the passage of the Third Harbor Tunnel beneath it without construction impacts occurring which would preclude its continuous operation. Temporary bridges across the Channel will also be provided. In these areas, temporary or permanent ramp closings on the Southeast Expressway/Central Artery, from Albany Street to Northern Avenue, will also occur, as will ramp closings, width restrictions and detours on the Frontage Road. Increases in effective travel times on the Central Artery will also occur.

The result for all build alternatives will be the redistribution of traffic from the bridges and ramps closed by construction to those which remain open. Some increases in traffic on local South Boston streets, including Dorchester Avenue from Andrew Square through Broadway, and South End streets including Albany Street, will occur; but they will be limited to those streets and intersections immediately adjacent to the Central Artery. Congestion points will be the immediate intersections at each bridge crossing with the roadways which parallel the Southeast Expressway/ Central Artery, including Dorchester Avenue/West Fourth Street, Dorchester Avenue/West Broadway, West Broadway/ Frontage Road, West Fourth Street/ Frontage Road, Summer Street/ Dorchester Avenue, and Congress Street/Dorchester Avenue.

Traffic increases will occur along Frontage Road as a result of the local bridge and Central Artery ramp closings when the Frontage Road itself is not being subjected to restrictive operating conditions (reduced width, closed ramps, detour roads); when it is being restricted, the shifts will occur back to the Central Artery or onto the parallel local streets, as previously described.

For both the split (Alternatives 2 and 3) and two-way (Alternatives 4 and 5) alignments, construction phasing provides for opening of the new, four-lane relocated Dorchester Avenue, including a new bridge across Fort Point Channel, as early as possible (early to mid-1989). This new facility will relieve construction traffic pressures on the Broadway Bridge.

In late 1989, the opening of the northbound Central Artery tunnel in Fort Point Channel under the split alignments (Alternatives 2 and 3) will further relieve construction period traffic which is utilizing local South Boston, South End, and downtown Boston streets parallel to the Central Artery.

<u>Central Artery/Surface Artery North of Dewey Square (Alternatives 2 and 3)</u>

Only the split alignment (Alternatives 2 and 3) will cause major construction period traffic impacts in this corridor. Construction will necessitate temporary or permanent ramp closings with the Central Artery from Atlantic Avenue and the Surface Artery,

temporary severance of the connection between Atlantic Avenue and the Surface Artery north of Northern Avenue, and lane/width restrictions on the Central Artery itself.

The Atlantic Avenue/Surface Artery connection north of Northern Avenue will not be closed until early 1989. Prior to that time, the Central Artery ramp closings and restrictions will divert some Artery traffic onto these streets and Commercial Street, as traffic seeks to rejoin the Artery further to the north. Dewey Square, Summer Street/Dorchester Avenue, Congress Street/Dorchester Avenue, Atlantic Avenue/Congress Street, and Atlantic Avenue/Northern Avenue will be major congestion points, due also to project construction in the adjacent Fort Point Channel.

East Boston Railroad Right-of-Way (Alternatives 2 and 4)

During construction of Alternatives 2 and 4 in East Boston, the Sumner, Maverick and Porter Street Bridges will alternately be closed; however, temporary crossings of the right-of-way will be provided (e.g., alternately at Marginal Street and Gove Street), resulting in the maintenance of traffic on at least three crossings (as today) at all times. Other than local diversions between Sumner, Maverick and Marginal Streets as each bridge is closed, there will be little change in overall traffic flows. Volumes will remain low on all three streets. With the Porter Street closing, much of the airport-related traffic using Porter Street will be diverted back onto the main airport access/egress roads, while the remaining, mostly local, traffic will use the Gove Street or other bridge crossings.

Logan Airport

Construction traffic impacts on the operation of Logan Airport will vary according to the alternative selected. The railroad alignments (Alternatives 2 and 4) pass along the western boundary of the airport near the present Airport Station on the MBTA's Blue Line, while the airport alignments (Alternatives 3 and 5) pass directly through airport property.

For Alternatives 2 and 4, modifications will be made to the ramp entering the airport from southbound Route 1A. These modifications involve the construction of a new right-hand off-ramp to the west of Route 1A (which will eventually be used as the connection from Route 1A southbound to the new Third Harbor Tunnel), connected to the main airport entrance road by a temporary one-lane detour road passing under Route 1A.

Construction of this ramp is expected to take nine months, and will cause some minor delays to inbound airport traffic from Route 1A north of the airport. Similarly, other construction in this same general area related to the tie-in of ramps from the new tunnel to the existing roadway network will also cause minor traffic delays as work progresses, although such impacts will be minimized by constructing these tie-ins during off-peak demand periods.

Alternative 2 construction also involves the temporary closing and eventual replacement of bridges over the railroad right-of-way at Sumner, Maverick, and Porter Streets. Traffic assignments indicate that only the Porter Street Bridge closing will have any noticeable effect on airport-related traffic. In this instance, most of the traffic normally using Porter Street as an alternative route into and out of the airport will utilize the airport's main access/egress roadways while Porter Street is out of service.

Alternatives 3 and 5 pass through the central portion of Logan Airport proper, and exit from the property near the MBTA Airport Station adjacent to Route 1A. During construction, portions of the main access and egress roads will be closed for six-month periods in order to allow a cut-and-cover tunnel section, allowing the connection between the

Third Harbor Tunnel and Route 1A northbound to be constructed. Although four-lane detour roads will be provided around this construction both for egress and access, some traffic delays can be expected.

The crossover service road connecting the main access and egress roads midway into the airport property will be replaced by a temporary four-lane detour road for six months, and will be completely closed with no direct detour road available for another six months. In the former case, resulting delays are expected to be minimal. In the latter situation, however, the complete roadway closure without a substitute road will force some motorists to make extensive detours. For example, motorists exiting from the Bird Island Flats area, wishing to travel towards Route 1A or to the air cargo area on the north side of the airport, will be required to make a right turn onto the main airport access road and loop around the airport through the passenger terminal areas.

As part of Alternatives 3 and 5, a new one-way airport service road will be built connecting the airport crossover road near the Pan American air freight building to Porter Street and the Bird Island Flats access road, as well as to the Third Harbor Tunnel itself. Construction of this roadway should have negligible effects on other airport traffic in the short term.

Other construction on airport property under Alternatives 3 and 5 will include a temporary two-lane detour of the Bird Island Flats access road for a duration of six months while the tunnel and toll booth area are constructed. Delays to traffic will be very minor.

The last remaining area of construction at the airport is the north service road. This roadway will be relocated slightly, but service will be maintained. Some minor delays to traffic passing through this area can be expected.

Public Transportation

Rapid Transit Service

Neither Blue Line nor Red Line services within the project area will be interrupted or otherwise affected by Alternatives 2 and 4 during construction. Construction will occur adjacent to and above the transit tunnels and will not require service disruptions. Any sensitive construction will be accomplished during night periods when the rapid transit lines are not in operation.

Red Line rapid transit service will not be affected by construction of Alternative 3 and 5, as for Alternatives 2 and 4. Blue Line service through East Boston, however, will be affected by construction of Alternatives 3 and 5. This results from the need to relocate approximately 1000 feet of track immediately to the north of the access and egress ramps to Logan Airport to provide clearance for construction of a new highway ramp in this same area. The relocation of this section of track and its tie-in to existing track can be accomplished with minimum to no disruption to Blue Line service, with the tie-ins occurring during night-time (no service) or weekend (off peak) periods.

Local Bus Services

Many of the MBTA's local bus routes in South Boston will be affected during construction of all four build alternatives as a result of the temporary bridge closings over the Fort Point Channel. Services will not be disrupted, but the bridge closings will shift bus routes utilizing the closed facility to other nearby bridges. Local bus service impacts will essentially be the same for all build alternatives on the Boston side, and are summarized below.

MBTA Routes 6 and 7 currently utilize the Summer Street Bridge over the Fort Point Channel. This bridge will be at reduced capacity for six months. It is expected that trip

times may be slightly lengthened due to congestion effects and because neighboring bridges will be closed at various times during construction, forcing the Summer Street Bridge to carry increased traffic.

Elsewhere in South Boston, MBTA Routes 9 and 11 utilize the Broadway Bridge. This bridge will be closed for a period of one year, during which time buses serving these routes will be detoured to the adjacent West Fourth Street Bridge. Again, this diversion will cause an increase in total trip time as will the congestion on the roadway network in this area resulting from the bridge closing itself. Similarly, when the West Fourth Street Bridge is closed for a year, resulting increased traffic on the Broadway Bridge will increase trip times.

In East Boston, the only local bus route affected by Third Harbor Tunnel construction is Route 120, during construction of the two railroad alignments (Alternatives 2 and 4). Route 120 utilizes bridges on both Maverick Street and Sumner Street to cross the railroad cut as part of a loop to the east of Maverick Square. Each of these bridges will be temporarily out of service for eight months under either Alternative 2 or Alternative 4. When the Maverick Street Bridge is closed, buses on Route 120 will detour from Maverick Street to either Sumner or Porter Streets in order to cross the railroad cut. When the Sumner Street Bridge is closed for a nine-month period under Alternatives 2 and 4, buses will use a temporary crossing at Marginal Street as a detour route, from which Sumner Street can be rejoined. Both temporary diversions will cause slight increases in total route trip times.

Airport Bus, Limousine, and Taxi Services

Construction of a Third Harbor Tunnel will cause minor delays to traffic accessing and egressing Logan Airport under all four build alternatives, including public transportation and private for-hire services. The access roadways and ramps will remain open at all times during construction, either through means of temporary detour roads or capacity (width) restrictions on the roadways themselves, which will cause some minor traffic delays.

The impacts of Alternatives 3 and 5 construction on airport, bus, limousine and taxi services will be more pronounced than Alternatives 2 and 4 because most of the East Boston construction under Alternatives 3 and 5 occurs on airport property, necessitating more and longer temporary road closures, restricted roadway widths, and detour roadways. The most significant construction period effect on the provision of these services will be the six-month period during which the airport crossover road is closed without provisions for a direct detour roadway, causing delays and circuitous routing for many of these vehicles.

Commuter Rail Services

No adverse impacts on commuter rail or Amtrak operations from South Station are anticipated during construction of any of the build alternatives. There are no impacts on North Station commuter rail services.

Express Bus Services

MBTA express buses to and from the North Shore via the Callahan and Sumner Tunnels and Route 1A may experience minor delays in the vicinity of Logan Airport ramps as construction proceeds in this area for the build alternatives. Some delays will also be incurred by express buses operated by both the MBTA and private carriers who utilize the Southeast Expressway and/or the Massachusetts Turnpike, due to staged construction, including temporary roadway closings and alternative detour routes in the vicinity of the Central Artery and Massachusetts Turnpike interchange. Additional delays will be encountered under Alternatives 2 and 3 further north on the Central Artery, as the

"split" connections are being constructed.

4.2.8 Design Refinements

During the design phase of this project, refinements to the design concepts of the selected alternative will be made to attempt to mitigate significant adverse transportation impacts. These especially include project roadway sections, ramps, and intersections where LOS F operation in 2010 are identified. The design for these particular locations had been based on preliminary traffic forecasts. Federal and State design standards have been adhered to for design elements of the build alternatives to promote safe and efficient motorist operation on all project roadways. Design refinements, which could include geometric as well as traffic signal timing modifications, will conform to these same standards.

The following identifies locations for potential design refinements for Alternatives 2 and 3 on the Boston side (split alignments).

- Northbound Southeast Expressway Connector to Central Artery in Fort Point Channel.

- Northbound Central Artery Off-ramp to Relocated Dorchester Avenue.

- Summer Street/Dorchester Avenue Intersection.

- Northbound Service Road Off-Ramp to Central Artery Northbound.

The following identifies locations for potential design refinements for Alternatives 4 and 5 on the Boston Side (two way alignments).

- Central Artery Northbound, between Frontage Road on-ramp and Third Harbor Tunnel off-ramp.

Locations for potential design refinements for Alternatives 2 and 4 on the East Boston side (railroad alignments) are as follows.

- Southbound Route 1A to Third Harbor Tunnel.

- Third Harbor Tunnel Northbound to Airport Access Roadway.

- Airport Egress Roadway to Third Harbor Tunnel.

4.2.9 Consequences of Other Transportation Improvements

The effect on traffic conditions resulting from various minor structural modifications to the existing highway facilities, from various transit system improvements, and from alternative toll collection practices has also been evaluated. The improvements discussed below can be implemented, individually or collectively, with or without a Third Harbor Tunnel. However, based on the traffic analyses performed, it has been concluded that implementation of these improvements would not serve as an adequate substitute for the Third Harbor Tunnel. More detailed treatment of these transportation improvements is contained in Appendix 4: Traffic.

Central Artery Ramp Modifications

As presented previously, level of service F traffic conditions on the northern section of the Central Artery, i.e. north of the Callahan/Sumner Tunnels, will continue regardless of which Third Harbor Tunnel alternative is ultimately selected. This is primarily due to the High-Level Bridge bottleneck and the high traffic volumes on this facility. This sub-section identifies several potential modifications to the Central Artery or its connecting roadways which can be made independently of a Third Harbor Tunnel project, and evaluates their effect on traffic conditions.

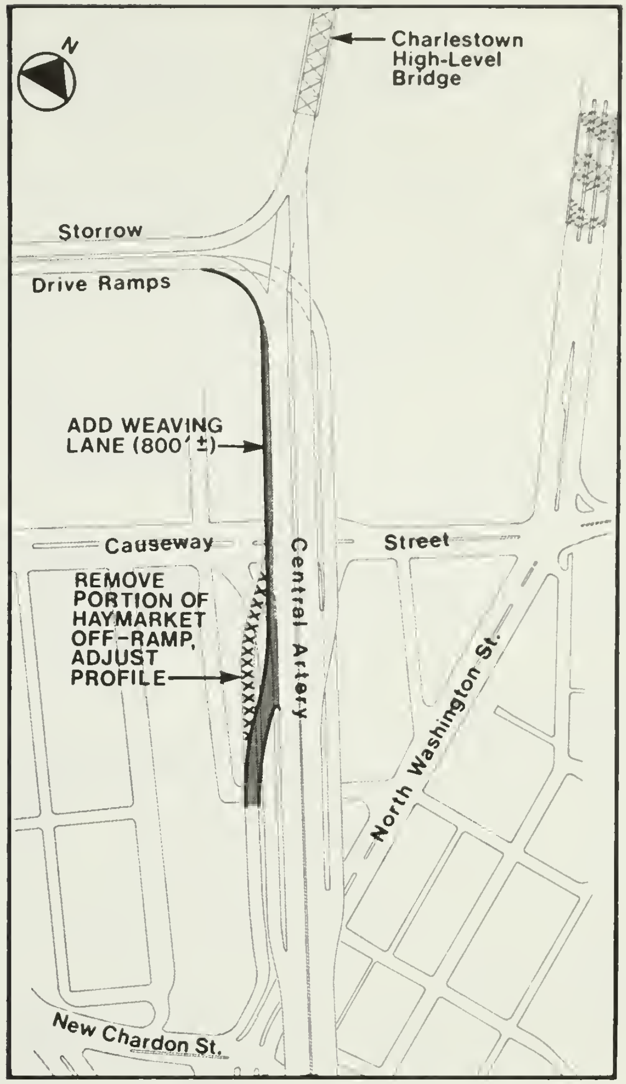
Only minor structural modifications (i.e., ramp reconstruction, addition of weaving

lanes between ramp terminals, channelization, surface street changes, etc.) were considered in this analysis. These modifications were evaluated in terms of their ability to improve traffic service, feasibility and construction cost. Since the Third Harbor Tunnel project addresses Central Artery modifications and traffic improvements south of the Atlantic Avenue ramps, this study was limited to that portion of the Central Artery between the northbound Atlantic Avenue on-ramp and the Storrow Drive interchange.

Modification A

This modification proposes the addition of a lane between the Storrow Drive on-ramp and the Haymarket Square off-ramp on the southbound Central Artery (see exhibit). This would allow the three southbound lanes on the Charlestown High-Level bridge to be continued, while Storrow Drive on-ramp traffic can enter the Central Artery in its own lane, which would be dropped at the Haymarket Square off-ramp. As part of this modification, the existing diverge (gore) area of the Haymarket Square off-ramp would be relocated approximately 225 feet to the south, thereby increasing the weaving distance in this area to 800 feet.

Currently, two travel lanes are striped in the southbound direction upstream of the Storrow Drive on-ramp; the on-ramp is striped as a one-lane ramp. Downstream of this merge area, the Central Artery is three lanes wide, thereby allowing on-ramp traffic to enter the Artery freely during off-peak periods. During peak periods, however, southbound Central Artery traffic enters this section in three lanes while on-ramp traffic enters in two lanes. Five lanes of traffic entering the three-lane highway section results in a disorderly merge area, creating confusion and turbulence to both traffic streams and, consequently reducing this roadway section's capacity.



MODIFICATION A

A traffic analysis was performed on this section for 2010 AM peak hour traffic and is summarized in Table 33. With all alternatives, including the No-Build Alternative, Modification A would only marginally improve traffic flow on this section of the Central Artery.

Addition of a lane would allow free entry for Storrow Drive on-ramp traffic while providing a continuous three lane section for southbound Central Artery traffic. During off-peak periods, traffic level of service would be improved. During peak periods, level of service would still be LOS F, although merging

Table 33

EFFECT OF RAMP MODIFICATIONS ON PEAK HOUR TRAFFIC OPERATIONS

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
MODIFICATION A*					
With Modification	F v/c=0.98	F v/c=0.97	F v/c=0.97	F v/c=0.96	F v/c=0.96
Without Modification	F v/c=1.14	F v/c=1.13	F v/c=1.13	F v/c=1.12	F v/c=1.12
MODIFICATION B*					
With Modification	F v/c=1.14	E v/c=0.97	E v/c=0.97	E v/c=0.98	E v/c=0.98
Without Modification	F v/c=1.14	F v/c=0.97	F v/c=0.97	F v/c=0.98	F v/c=0.98
MODIFICATION C*					
With Modification	F v/c=1.14	Ramp Discon-	Ramp Discon-	E v/c=0.98	E v/c=0.98
Without Modification	F v/c=1.14	tinued	tinued	F v/c=0.98	F v/c=0.98
MODIFICATION D*					
With Modification	F v/c=1.19	Ramp Replaced	Ramp Replaced	E v/c=0.97	E v/c=0.97
Without Modification	F v/c=1.19			F v/c=0.97	F v/c=0.97
MODIFICATION E	No v/c Analysis See Text for Effects				
MODIFICATION F*					
With Modification	F v/c=1.00	F v/c=1.07	F v/c=1.07	F v/c=1.01	F v/c=1.01
Without Modification	F v/c=1.24	F v/c=1.32	F v/c=1.32	F v/c=1.15	F v/c=1.15

* Refer to text for description of modifications.

NOTE: Levels of Service are determined from merge, diverge, or weaving areas as appropriate; v/c ratio is the value at the critical main line section.

turbulence would be reduced. Theoretical v/c ratios would be reduced from greater than 1.0 (exceed capacity) to less than 1.0 (less than capacity).

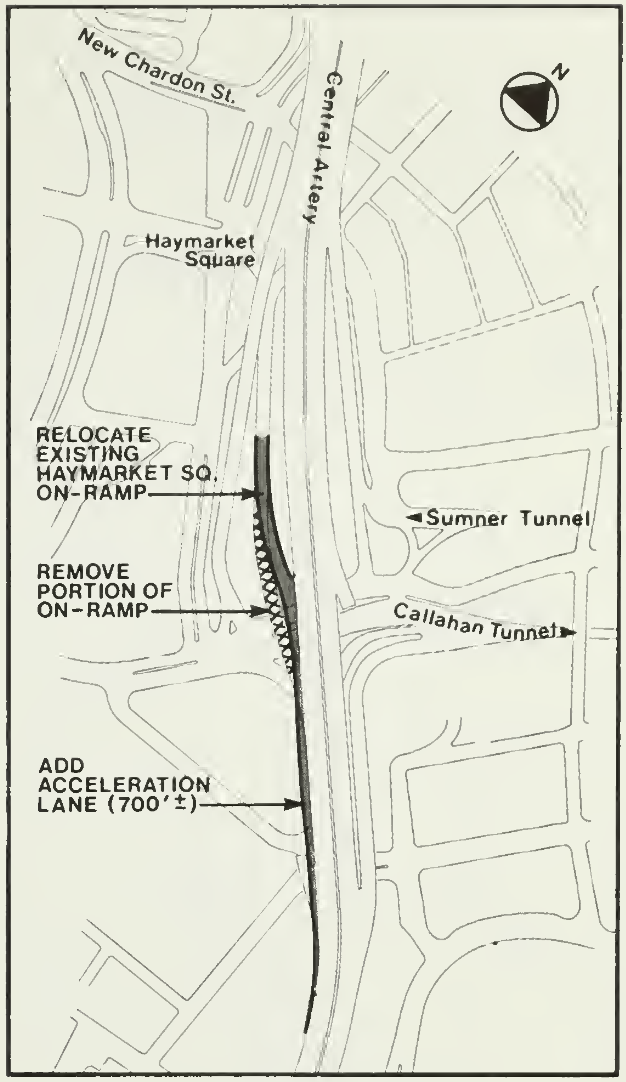
Modification A is estimated to cost $1.5 million, in 1982 dollars. Disruption to traffic during construction would be minimal, with no detours anticipated. Two to three travel lanes could be maintained on the Central Artery during construction, and the on- and off-ramps could remain functional.

Modification B

This modification proposes relocation of the existing southbound Haymarket Square on-ramp gore area approximately 175 feet to the north, and addition of an acceleration lane approximately 700 feet long (see exhibit).

At present, three lanes are striped on the southbound Central Artery while the on-ramp is striped for a one-lane entry. Essentially no acceleration lane exists. During peak periods, two lanes of traffic form on the on-ramp; consequently, three mainline Central Artery lanes and two on-ramp lanes attempt to merge into three lanes. This situation causes confusion and turbulence to both traffic streams, reducing the effective capacity of this highway section. Because off-peak traffic volumes are lower, and on-ramp traffic generally enters the Central Artery in one lane, this situation is not as pronounced during off-peak periods.

The traffic analysis performed on this highway section for 2010 AM peak hour traffic is also summarized in Table 33. With the build alternatives, Modification B would marginally improve traffic operations to within LOS E, because of improved operating speeds, even though v/c ratios remain unchanged. Under the No-Build Alternative, no improvement in operation would be realized because of no increase in speeds.



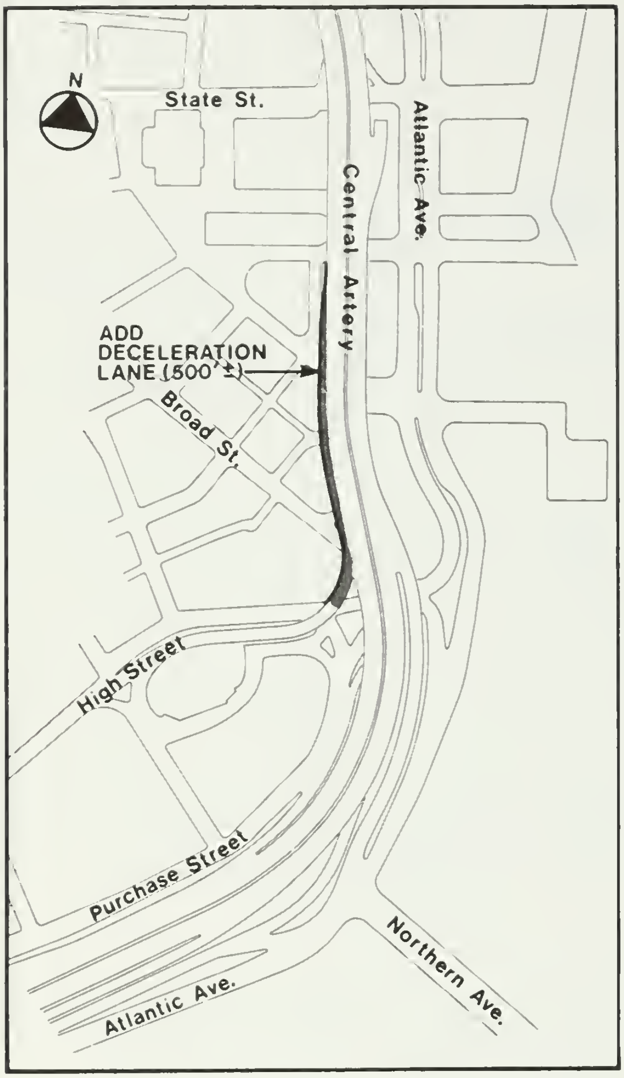
MODIFICATION B

During off-peak periods, traffic flow on this highway section would also be improved. On-ramp traffic would have approximately 700 feet in which to merge with mainline Central Artery traffic, as opposed to essentially no acceleration length at present.

Modification B is estimated to cost $1.3 million, in 1982 dollars. Traffic disruption during construction would be minimal, with no detours anticipated. Two to three travel lanes could be maintained on the Central Artery during construction of this modification, and the on-ramp could remain functional.

Modification C

This modification proposes construction of a 500-foot long deceleration lane on the southbound Central Artery approach to the High Street off-ramp (see exhibit).



MODIFICATION C

Presently, no deceleration lane exists, so exiting traffic must decelerate either in the right travel lane or on the exit ramp itself. The exit ramp is restrictive and dangerous because of its horizontal alignment. This situation is worse during off-peak periods because travel speeds are higher than during peak periods. However, during peak periods, exiting traffic slows the through traffic because of the absence of a deceleration lane.

The traffic analysis performed on this highway section for 2010 AM peak hour traffic is summarized in Table 33. For the No-Build Alternative, LOS F conditions would persist because of the high volume of traffic using this exit. For Alternatives 4 and 5, conditions would improve to LOS E, due to improved operating speeds, with no v/c ratios changed. (With Alternatives 2 and 3, this off-ramp will be replaced with a new exit as part of the Third Harbor Tunnel project.) During off-peak periods, traffic flow would be improved and safety enhanced with the addition of this deceleration lane for Alternatives 4 and 5.

Modification C is estimated to cost $500,000, in 1982 dollars. Traffic disruption during construction would be minimal, with no detours anticipated. Two to three travel lanes could be maintained on the southbound Central Artery during construction of this modification, and the off-ramp could remain in service.

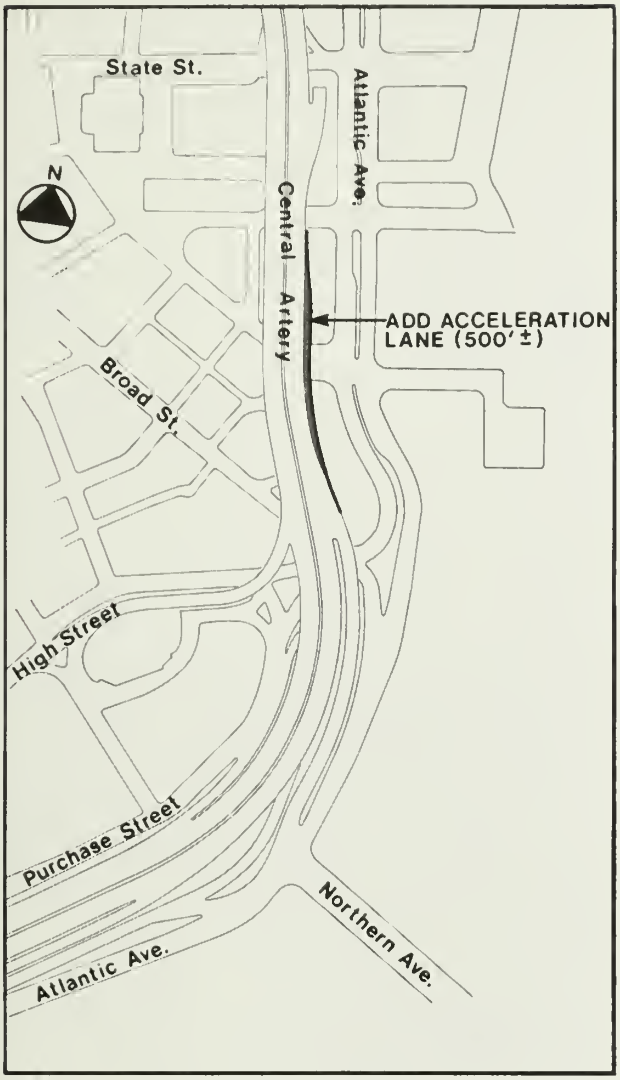
Modification D

This modification proposes lengthening the acceleration lane for the northbound Northern Avenue on-ramp to the Central Artery from the existing 200 feet to 500 feet (see exhibit). Presently travel speeds and capacity of the merge area are reduced because of the short acceleration lane.

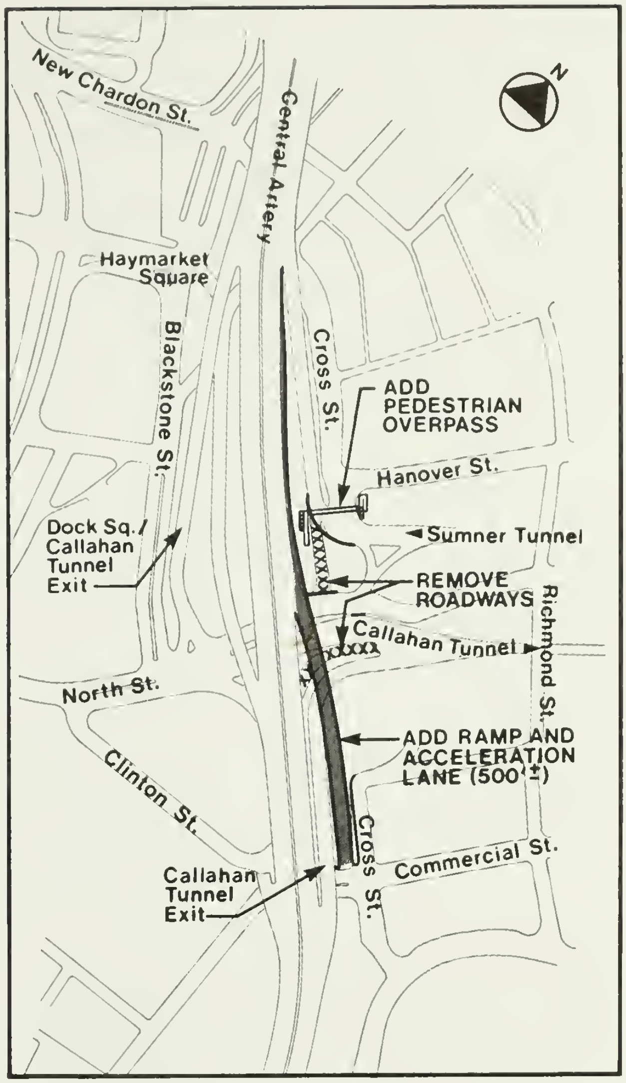
The traffic analysis performed on this section for 2010 AM peak hour traffic is summarized in Table 33. With the No-Build Alternative, traffic operations at this location would not improve with Modification D. However, with Alternatives 4 and 5, conditions improve to LOS E due to improved traffic operating conditions and speeds with no v/c ratio change. (This modification would not apply to Alternative 2 and 3, which will replace the existing on-ramp as part of the project.)

Modification D is estimated to cost $400,000, in 1982 dollars. Traffic disruption during construction

would be minimal, with no detours anticipated. Two to three travel lanes could be maintained on the Central Artery during construction, and the on-ramp could remain in service.



MODIFICATION D



MODIFICATION E

Modification E

This modification (see exhibit) proposes several roadway changes in the vicinity of the Callahan and Sumner Tunnel portals, and the addition of a new on-ramp from Commercial Street to the Central Artery northbound.

Eliminate Surface Artery/ Tunnel Direct Connection. Substantial delays are encountered entering the Callahan Tunnel in the PM peak hour because seven lanes of traffic have just 300 feet to funnel into the two lane tunnel: three lanes from North Street, two lanes from the Central Artery and two lanes from the Surface Artery. (Note - the Surface Artery does not show on this exhibit because it runs at-grade under the elevated Central Artery.) This situation occasionally results in queues from the tunnel reaching the Callahan Tunnel off-ramp from the

Central Artery northbound, and also reaching the North Street/Blackstone Street/off-ramp intersection on North Street. To lessen congestion at the Callahan Tunnel portal and to provide more orderly flow into the tunnel, it would be necessary to eliminate some of the lanes leading to the tunnel. Of the three approaches, elimination of the Surface Artery approach would result in the least circuitous diversion of traffic. Rather than proceeding straight on the Surface Artery to the Callahan Tunnel, traffic would turn left onto Clinton Street and right onto North Street, before entering the Callahan Tunnel. For the build alternatives, between 600 and 800 vehicles in the PM peak hour would be diverted to this route. With the No-Build Alternative, approximately 1360 vehicles would be diverted.

Queues on North Street would increase dramatically with this change, particularly for the No-Build Alternative. However, queues on the northbound off-ramp to the Callahan Tunnel would be reduced, improving northbound Central Artery operations, because exiting traffic would only have to merge with three other lanes of traffic rather than five at the tunnel entrance. This improvement will also be at the expense of southbound Central Artery operation, which will be adversely affected by increased delays on the southbound Dock Square/Callahan Tunnel off-ramp from the Central Artery.

Cross Street Pedestrian Overpass. Traffic exiting the Sumner Tunnel must turn sharply to the right to get to Cross Street or Hanover Street, causing a reduction in speed and a less efficient traffic flow. In addition, the at-grade pedestrian crossing at Cross Street near the tunnel portal creates conflicts and delays for exiting traffic. A pedestrian overpass from the area between Hanover Street and the Sumner Tunnel portal, across Cross Street to the City parking lot, would eliminate some conflicts for Sumner Tunnel traffic. This pedestrian overpass would also improve safety by removing the existing pedestrian/vehicular conflict.

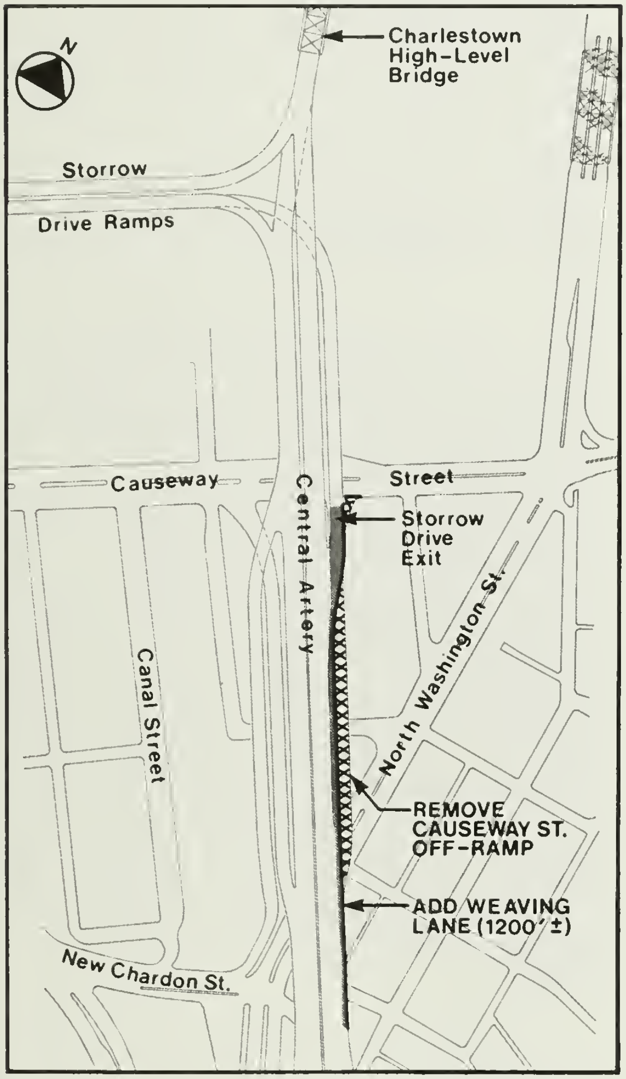
North Street/Central Artery Northbound Connection Closing and New Northbound Artery On-Ramp. Traffic exiting the Sumner Tunnel bound for either the Central Artery northbound or Cross Street also conflicts with North Street traffic. For 2010 AM peak hour traffic forecasts with the No-Build Alternative, nearly 3700 vehicles per hour exiting the Sumner Tunnel conflict with nearly 650 vehicles from North Street. With the build alternatives, approximately 2500 vehicles exiting the Tunnel conflict with approximately 700 vehicles from North Street. To eliminate these conflicts, it would be necessary to remove the existing roadway between North Street and the northbound Central Artery on-ramp and to close the U-turn slot in front of the former Tunnel Administration building. The traffic which now uses the U-turn slot to get to Cross Street and Hanover Street would be diverted into the North End via North Street, Richmond Street, and Hanover Street. North Street traffic bound to the Central Artery northbound would be redirected at the North Street/Blackstone Street intersection southbound on the Surface Artery to Commercial Street, then easterly to a new Central Artery on-ramp near the intersection of Commercial Street, Cross Street and Surface Artery. A 500-foot long acceleration lane would be provided. With this modification, traffic exiting from the city parking lot bound for the northbound Central Artery would travel a very circuitous route via North, Richmond, Hanover, Cross, and Blackstone Streets, and the Surface Artery, to the new northbound on-ramp.

The aggregate cost of Modification E is estimated at nearly $2.2 million in 1982 dollars including modifications to existing signalized intersections. Disruption to traffic during the construction period would be minimal. To minimize traffic disruptions, the new on-ramp would be constructed prior to removal of the

connection from North Street to the Central Artery northbound on-ramp.

Modification F

This modification proposes addition of a 1200-foot long lane on the northbound Central Artery between the Sumner Tunnel on-ramp and the Storrow Drive off-ramp, to reduce weaving conflicts. The Causeway Street exit would be removed (see exhibit).



MODIFICATION F

For 2010 AM peak hour traffic, approximately 1000 vehicles per hour would be diverted from the Causeway Street ramp with the No-Build Alternative and Alternatives 4 and 5. With Alternatives 2 and 3, this volume is closer to 1500 vehicles. These vehicles could exit the Central Artery via the Storrow Drive off-ramp, and enter Causeway Street via the local roadway network. However, the required routing for motorists destined to Causeway Street as well as the North End and Charlestown would be extremely circuitous.

Northbound Central Artery traffic flow would be improved since a continuous four-lane cross-section would be provided between the Sumner Tunnel on-ramp and Storrow Drive off-ramp on the northbound Central Artery. This configuration will permit a two-lane exit from the Central Artery to Storrow Drive. With the addition of 1500 vehicles to the Storrow Drive off-ramp with Alternatives 2 and 3, however, the future peak hour volume on this ramp would be approximately 4000 vehicles, the absolute capacity of a two-lane ramp. With the No-Build Alternative and Alternatives 4 and 5, the Storrow Drive peak hour off-ramp traffic would be about 3600 vehicles.

The traffic analysis performed on this highway section is summarized in Table 33. Traffic operations would be improved with all alternatives, although LOS F will still prevail. Theoretical v/c ratios will all be reduced to approximately capacity (1.0) conditions.

Modification F is estimated to cost $650,000 in 1982 dollars. Disruptions to traffic during construction should be minimal, with no detours anticipated. Construction of the additional lane should be completed prior to the removal of the Causeway Street off-ramp.

Combined Modification E and F

Because Modifications E and F are so close, the effects on traffic flow of implementing both modifications have been evaluated. The construction of these individual modifications as described above would require a continuous weaving lane, from the Commercial Street on-ramp to the Storrow Drive off-ramp.

In terms of Central Artery levels of service and volume-to-capacity ratios, no calculable difference can be determined between implementing Modification F and implementing Modifications E and F together. Traffic volumes between the Sumner Tunnel on-ramp and the Storrow Drive off-ramp will be the same under both conditions, therefore v/c ratios will be as indicated for Modification F. The weaving analysis performed for Modification F indicated that LOS F operation would prevail. Although the construction of Modifications E and F would divert 650 to 700 vehicles per hour from the Sumner Tunnel on-ramp to the new Commercial Street on-ramp, the weaving section north of the Sumner Tunnel on-ramp will nevertheless continue to operate at LOS F.

Summary

The level of service improvements from these minor structural modifications are marginal. Although portions of the Central Artery may be improved operationally by these modifications, the High-Level Bridge and other bottlenecks and heavy traffic volumes will continue to adversely affect overall operations on the Central Artery.

Public Transportation

Improved Blue Line Service

Potential improvements to the MBTA's Blue Line rapid transit service include a new spur directly into the airport property to a central station area, with moving sidewalk connections to all airport terminals; a new downtown Boston direct connection between the Blue and Red Lines; escalators at all stations; and other minor changes.

A previous study prepared for Massport estimated that 5103 daily airport vehicle-trips in each direction (airline passengers and employees) could be shifted from the highway network to an improved Blue Line service, with a direct connection to the airport. The distribution of this traffic volume reduction on the highway network is summarized in Table 34 for the No-Build Alternative. These values reflect the optimistic assumption that all traffic removed would be cross-harbor traffic.

Table 34 also illustrates traffic reductions, v/c ratios and levels of service from Blue Line improvements for the build alternatives. It was assumed that total diversions of trips from the highway network to the Blue Line would be the same for the build alternatives as for the No-Build. This assumption is again optimistic, since the overall traffic flow improvements from the build alternatives would probably offer less incentive for motorists to switch to public transit.

Table 34 indicates that volume reductions at the selected roadway locations for the build alternatives are less, in absolute terms, than those shown for the No-Build Alternative. This results from the availability of an additional cross-harbor route. For example, daily traffic reduction on the Central Artery to the immediate south of the Callahan/Sumner Tunnels with the build alternatives is less than 250 vehicles in each direction as compared to over 2000 for the No-Build case. This is because most airport-related traffic from the south, southwest, and west would be diverted to the Blue Line from the new Third Harbor Tunnel, not from the Callahan/Sumner Tunnels and the south portions of the Central Artery.

Resulting traffic reductions are generally not significant, especially further away from the airport. For example, changes in level of service would occur on the Airport ramps during the AM and PM peak hours (E to D outbound under the build and No-Build Alternatives - AM peak; F to E outbound under the No-Build Alternatives - PM peak; and D to C inbound under the build alternatives - PM peak), and in the

Table 34

EFFECTS OF IMPROVED BLUE LINE SERVICE ON 2010 TRAFFIC

	AM Peak Hour				PM Peak Hour				AWDT	
	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction
NO-BUILD ALTERNATIVE										
Logan Airport Ramps										
Inbound	2130	380	None (F)	1.33 to 1.09	2110	360	None (F)	1.30 to 1.08	29,000	5100
Outbound	1330	260	E to D	0.86 to 0.69	1780	420	F to E	1.15 to 0.88	16,000	5100
Sumner Tunnel	3690	260	None (F)	1.19 to 1.10	3260	420	F to D	1.05 to 0.92	47,500	5100
Callahan Tunnel	3150	380	F to D	1.01 to 0.89	4070	360	None (F)	1.31 to 1.19	47,200	5100
Central Artery (North of Existing Tunnels)										
Northbound	7220	120	None (F)	1.27 to 1.14	6070	190	None (F)	1.02 to 0.97	88,500	2300
Southbound	6080	170	None (F)	1.11 to 0.90	5180	160	None (F)	0.97 to 0.78	84,600	2300
Central Artery (South of Existing Tunnels)										
Northbound	6420	160	None (F)	1.22 to 1.19	6030	150	None (F)	1.15 to 0.87	89,500	2140
Southbound	6190	110	None (F)	1.14 to 1.12	5400	180	None (F)	0.98 to 0.94	83,900	2140
BUILD ALTERNATIVES (Average)										
Logan Airport Ramps										
Inbound	1490	220	None (E)	0.93 to 0.79	1240	200	D to C	0.77 to 0.64	17,800	2350
Outbound	1280	170	E to D	0.82 to 0.72	1430	220	None (E)	0.92 to 0.77	15,900	2490
Sumner Tunnel	2530	170	None (C)	0.81 to 0.76	1910	220	None (C)	0.61 to 0.54	29,150	2490
Callahan Tunnel	1960	220	None (C)	0.63 to 0.56	2430	200	None (C)	0.78 to 0.72	30,600	2350
Central Artery (North of Existing Tunnels)										
Northbound	7520	110	None (F)	1.23 to 1.22	6350	150	None (F)	1.03 to 1.02	89,100	1690
Southbound	6390	150	None (F)	0.99 to 0.97	5210	140	F to E	0.81 to 0.79	84,500	1600
Central Artery (South of Existing Tunnels)										
Northbound	5660	20	None (F)	1.08 to 1.07	5160	20	None (F)	None (0.98)	71,900	240
Southbound	5310	20	None (F)	1.0 to 0.99	4930	20	None (E)	0.92 to 0.91	74,200	250

Sumner Tunnel (F to D under the No-Build Alternative in the PM peak hour, and likewise in the Callahan Tunnel for the No-Build Alternative in the AM peak hour). The Central Artery north of the existing tunnels would experience a level of service improvement (from F to E) in the southbound direction under the build alternatives. No other changes would occur during morning or evening peak hours.

Improved Suburban Bus and Limousine Service

From a previous study prepared for Massport, it was estimated that improved suburban bus and limousine service to and from Logan Airport would divert approximately 1900 daily vehicle trips in each direction from the highway network to transit. The distribution of this highway network volume reduction is summarized in Table 35 for the No-Build and build alternatives. These distributions assume that 80 percent of total highway volume reductions come from cross-harbor traffic.

Table 35 shows that peak hour volumes for the No-Build Alternative would be reduced by less than 60 vehicles per hour in each direction on the Central Artery and by generally less than 130 vehicles per hour in each direction through the existing tunnels. Such reductions are small (less than one percent on the Central Artery and less than four percent in the tunnels) when compared to the total traffic on these roadways.

For the build alternatives, traffic reductions along the Central Artery and through the Callahan and Sumner Tunnels would be even more minor on both a peak hour and daily basis, as shown in Table 35.

Cross-Harbor Ferry Service

A recent Massport study examined several possible locations for a cross-harbor ferry service terminal specifically designed to attract auto drivers and their passengers. The study showed that for the No-Build Alternative, in 2010 the ferry service would attract 2,937 daily riders or 163 peak hour riders. This number of passengers translates into the vehicular traffic reductions into and out of the airport, summarized in Table 36. Also summarized are reductions for the build alternatives.

Table 36 shows that with the cross-harbor ferry service, reduction on the Central Artery and at other locations for the No-Build Alternative would be generally less than those resulting from the Blue Line improvements but similar to those from suburban bus/limousine improvements. Similar results are shown in Table 36 for the "build" alternatives.

This table also shows that only the Callahan Tunnel would benefit by improved level of service, from F to D, during the AM peak hour for the No-Build Alternative. Only the Airport inbound ramp's level of service would improve under the build alternatives, from D to C.

Summary

Improved cross harbor public transportation services, serving airport passengers and employees, can contribute to reductions in traffic volume on the existing tunnels and on sections of the Central Artery. However, their effects on Central Artery traffic level of service are minor because of the high residual volumes which will remain on this roadway.

Alternative Toll Collection Practices

This subsection assesses the effects of various one-way and differential toll collection practices on 2010 traffic for all alternatives. The results are not intended to be used to determine the desirability of alternative toll collection practices, but instead are intended to provide "order-of- magnitude" traffic effects associated with these practices.

Table 35

EFFECTS OF IMPROVED BUS/LIMOUSINE SERVICE ON 2010 TRAFFIC

	AM Peak Hour				PM Peak Hour				AWDT	
	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction
NO-BUILD ALTERNATIVE										
Logan Airport Ramps										
Inbound	2130	140	None (F)	1.33 to 1.24	2110	140	None (F)	1.30 to 1.22	29,000	1910
Outbound	1330	100	None (E)	0.86 to 0.79	1780	160	None (F)	1.15 to 1.05	16,000	1910
Sumner Tunnel	3690	80	None (F)	1.19 to 1.16	3260	130	None (F)	1.05 to 1.01	47,500	1530
Callahan Tunnel	3150	120	F to D	1.01 to 0.98	4070	110	None (F)	1.31 to 1.28	47,200	5100
Central Artery (North of Existing Tunnels)										
Northbound	7220	40	None (F)	1.27 to 1.16	6070	60	None (F)	1.02 to 0.99	88,500	690
Southbound	6080	50	None (F)	1.11 to 0.92	5180	50	None (F)	0.97 to 0.80	84,600	690
Central Artery (South of Existing Tunnels)										
Northbound	6420	50	None (F)	1.22 to 1.21	6030	50	None (F)	1.15 to 1.14	89,500	640
Southbound	6190	30	None (F)	None (1.14)	5400	50	None (F)	0.98 to 0.97	83,900	640
BUILD ALTERNATIVES (Average)										
Logan Airport Ramps										
Inbound	1490	80	None (E)	0.93 to 0.88	1240	80	D to C	0.77 to 0.72	17,800	880
Outbound	1280	60	None (E)	0.82 to 0.78	1430	90	None (E)	0.92 to 0.86	15,900	950
Sumner Tunnel	2530	50	None (C)	0.81 to 0.80	1910	70	None (C)	0.61 to 0.59	29,150	740
Callahan Tunnel	1960	70	None (C)	0.63 to 0.61	2430	60	None (C)	0.78 to 0.76	30,600	700
Central Artery (North of Existing Tunnels)										
Northbound	7520	30	None (F)	1.23 to 1.22	6350	50	None (F)	1.03 to 1.02	89,100	510
Southbound	6390	50	None (F)	0.99 to 0.98	5210	40	None (F)	0.81 to 0.80	84,500	480
Central Artery (South of Existing Tunnels)										
Northbound	5660	10	None (F)	None (1.08)	5160	10	None (F)	None (0.98)	71,900	70
Southbound	5310	10	None (F)	None (1.0)	4930	10	None (E)	0.92 to 0.91	74,200	80

Table 36

EFFECTS OF CROSS-HARBOR FERRY SERVICE ON 2010 TRAFFIC

	AM Peak Hour				PM Peak Hour				AWDT	
	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction	LOS Change	V/C Change	Forecast Volume	Volume Reduction
NO-BUILD ALTERNATIVE										
Logan Airport Ramps										
Inbound	2130	130	None (F)	1.33 to 1.25	2110	100	None (F)	1.30 to 1.24	29,000	1930
Outbound	1330	90	None (E)	0.86 to 0.80	1780	110	None (F)	1.15 to 1.07	16,000	1930
Sumner Tunnel	3690	90	None (F)	1.19 to 1.16	3260	110	None (F)	1.05 to 1.01	47,500	1930
Callahan Tunnel	3150	130	F to D	1.01 to 0.97	4070	100	None (F)	1.31 to 1.28	47,200	1930
Central Artery (North of Existing Tunnels)										
Northbound	7220	20	None (F)	1.27 to 1.16	6070	20	None (F)	1.02 to 1.00	88,500	390
Southbound	6080	30	None (F)	1.11 to 0.93	5180	20	None (F)	0.97 to 0.80	84,600	390
Central Artery (South of Existing Tunnels)										
Northbound	6420	70	None (F)	1.22 to 1.21	6030	60	None (F)	1.15 to 1.14	89,500	1060
Southbound	6190	50	None (F)	1.14 to 1.13	5400	60	None (F)	0.98 to 0.97	83,900	1060
BUILD ALTERNATIVES (Average)										
Logan Airport Ramps										
Inbound	1490	80	None (E)	0.93 to 0.88	1240	60	D to C	0.77 to 0.73	17,800	1000
Outbound	1280	70	None (E)	0.82 to 0.78	1430	70	None (E)	0.92 to 0.87	15,900	1060
Sumner Tunnel	2530	70	None (C)	0.81 to 0.79	1910	70	None (C)	0.61 to 0.59	29,150	1060
Callahan Tunnel	1960	80	None (C)	0.63 to 0.61	2430	60	None (C)	0.78 to 0.76	30,600	1000
Central Artery (North of Existing Tunnels)										
Northbound	7520	20	None (F)	1.23 to 1.22	6350	20	None (F)	1.03 to 1.07	89,100	370
Southbound	6390	30	None (F)	None (0.99)	5210	20	None (F)	None (0.81)	84,500	350
Central Artery (South of Existing Tunnels)										
Northbound	5660	10	None (F)	None (1.08)	5160	10	None (F)	None (0.98)	71,900	100
Southbound	5310	10	None (F)	None (1.00)	4930	10	None (E)	0.92 to 0.91	74,200	110

Five toll collection practices were considered in order to evaluate a range of possible traffic conditions in 2010. These practices include:

o Option 1 (Base Condition). All toll crossings have two-way toll collection. Current (1982) toll fees per vehicle are assumed.

o Option 2. All toll crossings have one-way toll collection. Current toll fees per vehicle are doubled in the inbound (to Boston) direction and eliminated in the outbound direction.

o Option 3. The Callahan and Sumner Tunnels and (if applicable) Third Harbor Tunnel have two-way toll collection, with current toll fees per vehicle assumed. The Mystic-Tobin Bridge has one-way toll collection, with current toll fees per vehicle doubled in the inbound direction and eliminated in the outbound direction.

o Option 4. The Mystic-Tobin Bridge has two-way toll collection, with current toll fees per vehicle assumed. One-way toll collection is assumed for the Callahan/Sumner Tunnels, and (if applicable) Third Harbor Tunnel, with current toll fees per vehicle doubled in the inbound direction.

o Option 5. All toll crossings have two-way toll collection. Current toll fees per vehicle are assumed for the Mystic-Tobin Bridge; toll fees per vehicle for all tunnel crossings are double the current fees in each direction.

This analysis assumed the following:

o Under all options, the Massachusetts Turnpike Authority (MTA) will have identical tolls for all of its tunnels, and all tunnels will operate under the same toll collection policy -- whether one-way or two-way.

o Four traffic facilities will be affected -- I-93/Rutherford Avenue; the Mystic-Tobin Bridge; Callahan/ Sumner Tunnels; and, for the build alternatives, the Third Harbor Tunnel.

o No trips are assumed to be "lost" or "cancelled" under the various toll collection options. All vehicle trips are assumed to be diverted to competing facilities.

Findings

Traffic diversion estimates, summarized in Table 37, were made for Options 2 through 5 and compared to Option 1 (base case). The largest inbound diversions are expected under Option 5 (two-way tolls; 100 percent increase in MTA tunnels tolls). For this option, under No-Build conditions, daily traffic would decrease by 3.0 percent through the Sumner Tunnel while the traffic on the Mystic-Tobin Bridge would increase by 1.9 percent. The I-93/Rutherford Avenue corridor would also experience a minor increase. For the build options, the decrease through the Sumner Tunnel would be 5.2 percent and the decrease in the Third Harbor Tunnel would be 3.4 percent. The Mystic-Tobin Bridge would have its traffic increased by 6.0 percent. Again, there would be minor diversion to the I-93/Rutherford Avenue corridor. The lowest diversions would occur under Option 2 (concurrent one-way tolls for all facilities). For that option, under both build and no-build conditions, traffic would be diverted from the tunnels and the bridge to the I-93/Rutherford Avenue corridor. The greatest diversion of traffic would occur from the Mystic-Tobin Bridge but the diversion is relatively small at 2.4 percent.

Diversion estimates shown on Table 37 are intended to represent differences in traffic flow under equilibrium conditions. Equilibrium conditions occur when traffic patterns become re-established after a change in toll policy has been implemented. This usually occurs less than a year after a conversion.

Whether one-way or two-way toll collection is used, tunnel capacity will not be affected. Even more

Table 37

TRAFFIC IMPACTS OF ALTERNATIVE TOLL COLLECTION PRACTICES

Third Harbor Tunnel Alternative	Option 1 Year 2010 AWDT Inbound	Variance from Option 1 (Base Case) (percent)			
		Option 2	Option 3	Option 4	Option 5
1 - No-Build					
Callahan/Sumner	44,600	-1.0	+1.3	-2.0	-3.0
Mystic-Tobin	42,000	-2.4	-3.9	+1.4	+1.9
I-93/Rutherford Ave.	72,100	+1.9	+1.4	+0.4	+0.7
2					
Callahan/Sumner	29,500	-1.9	+1.4	-2.7	-5.2
Mystic-Tobin	28,300	-2.4	-3.9	+2.5	+6.0
Third Harbor	37,900	-1.1	+0.5	-1.7	-3.4
I-93/Rutherford Ave.	74,800	+2.3	+0.7	+1.0	+1.5
3					
Callahan/Sumner	29,000	-1.9	+1.4	-2.7	-5.2
Mystic-Tobin	29,200	-2.4	-3.9	+2.5	+6.0
Third Harbor	37,000	-1.1	+0.5	-1.7	-3.4
I-93/Rutherford Ave.	76,400	+2.2	+0.7	+1.0	+1.5
4					
Callahan/Sumner	28,800	-1.9	+1.4	-2.7	-5.2
Mystic-Tobin	28,200	-2.4	-3.9	+2.5	+6.0
Third Harbor	39,300	-1.1	+0.5	-1.7	-3.4
I-93/Rutherford Ave.	70,700	+2.3	+0.7	+1.0	+1.5
5					
Callahan/Sumner	29,500	-1.9	+1.4	-2.7	-5.2
Mystic-Tobin	29,300	-2.4	-3.9	+2.5	+6.0
Third Harbor	38,200	-1.1	+0.5	-1.7	-3.4
I-93/Rutherford Ave.	74,600	+2.3	+0.7	+1.0	+1.5

Note: See text for description of options

significant, from the standpoint of this traffic analysis, one-way tolls or reasonable differential tolls (even double that of one facility versus the other) will not significantly alter harbor crossing circulation patterns. Although not specifically analyzed, elimination of the outbound toll would probably improve air quality and noise characteristics of the area.

4.3 RELOCATION IMPACTS

4.3.1 Residential Takings

No residential properties are taken or acquired for any of the five alternatives; therefore, no residential relocations are necessary.

4.3.2 Business Takings

Each of the four build alternatives requires property acquisitions displacing several businesses, and therefore requiring their relocation. In the discussions which follow, all references to acquisitions of properties or buildings refer only to those properties whose tenants'/owners' businesses would be displaced by the proposed project alternatives. Other, partial property acquisitions would occur as part of this project, but would not necessitate businesses being displaced or relocated.

The No-Build Alternative requires no relocations. In summary, Alternative 2 will displace 12 buildings or sites causing 16 businesses with 245 employees to relocate; Alternative 3 will displace 9 buildings or sites affecting 24 businesses, including one government office, and 510 employees; Alternative 4 will displace 11 buildings or sites affecting 14 businesses and 170 employees; and Alternative 5 will displace 7 buildings (one of them a partial taking) or sites causing 22 businesses, including one government office, and 435 employees to relocate. Figure 35 locates the displaced businesses on Alternatives 2 and 3 on the Boston side of the Harbor and Alternatives 2 and 4 in East Boston; Figure 36 locates the displaced businesses of Alternatives 3 and 5 at Logan Airport. (Alternatives 4 and 5 do not displace businesses on the Boston side of the Harbor.)

SUMMARY OF REQUIRED RELOCATIONS FOR EACH BUILD ALTERNATIVE BY BUSINESS TYPE

Businesses/Employees Listed by Alternative

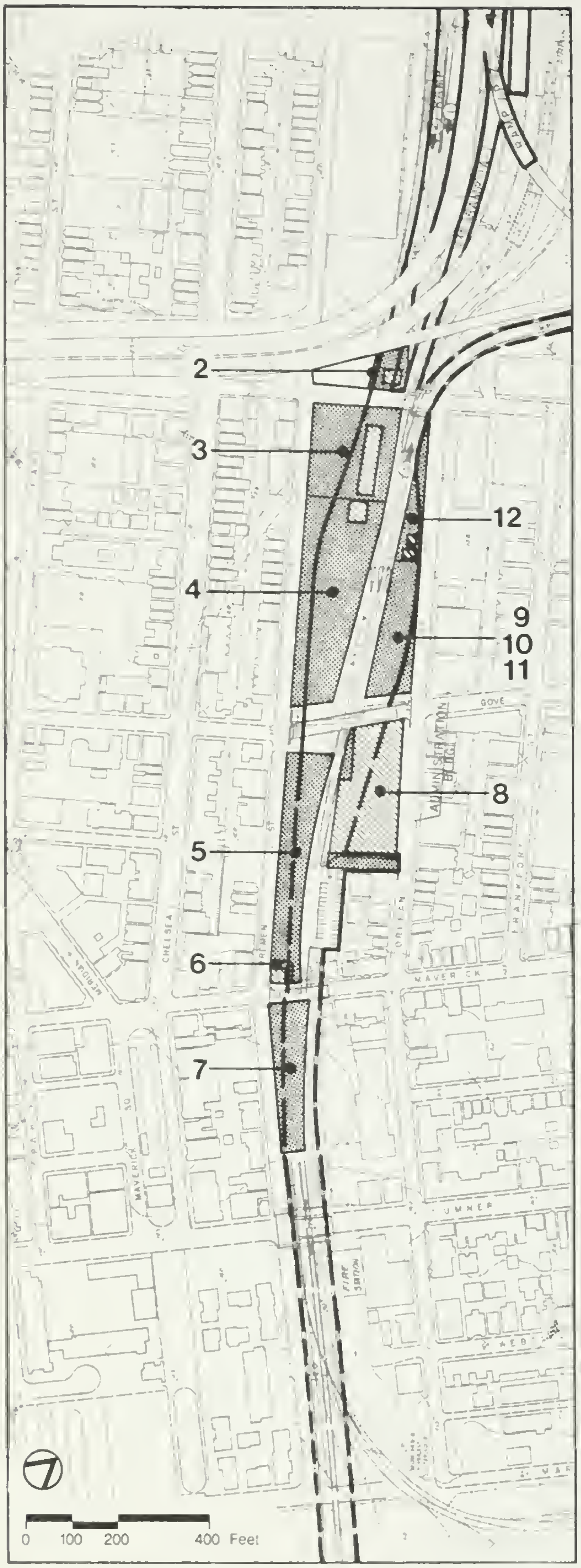
Use	Alternative 2	3	4	5
Mfg/W'hse				
businesses	4	2	2	0
employees	108	75	33	0
Service				
8usinesses	11	21	11	21
employees	134	414	134	414
Other				
businesses	1	1	1	1
employees	3	21	3	21
Total				
businesses	16	24	14	22
employees	245	510	170	435

Alternative 2

This alternative includes the "split alignment" on the Boston side of the project area and the "railroad alignment" in East Boston. It will acquire 12 properties or buildings which accommodate 16 businesses. The following types of businesses are affected: one property management/ real estate office, three manufacturers, one freight forwarder, seven car rental and/or parking facilities, one car maintenance/ parking facility, one warehouse, one travel counter, and one courier service.

Alternative 3

This alternative includes the "split alignment" on the Boston side of the project area and the "airport alignment" in East Boston. It will acquire nine properties or buildings supporting 23 businesses, plus an FAA



Legend

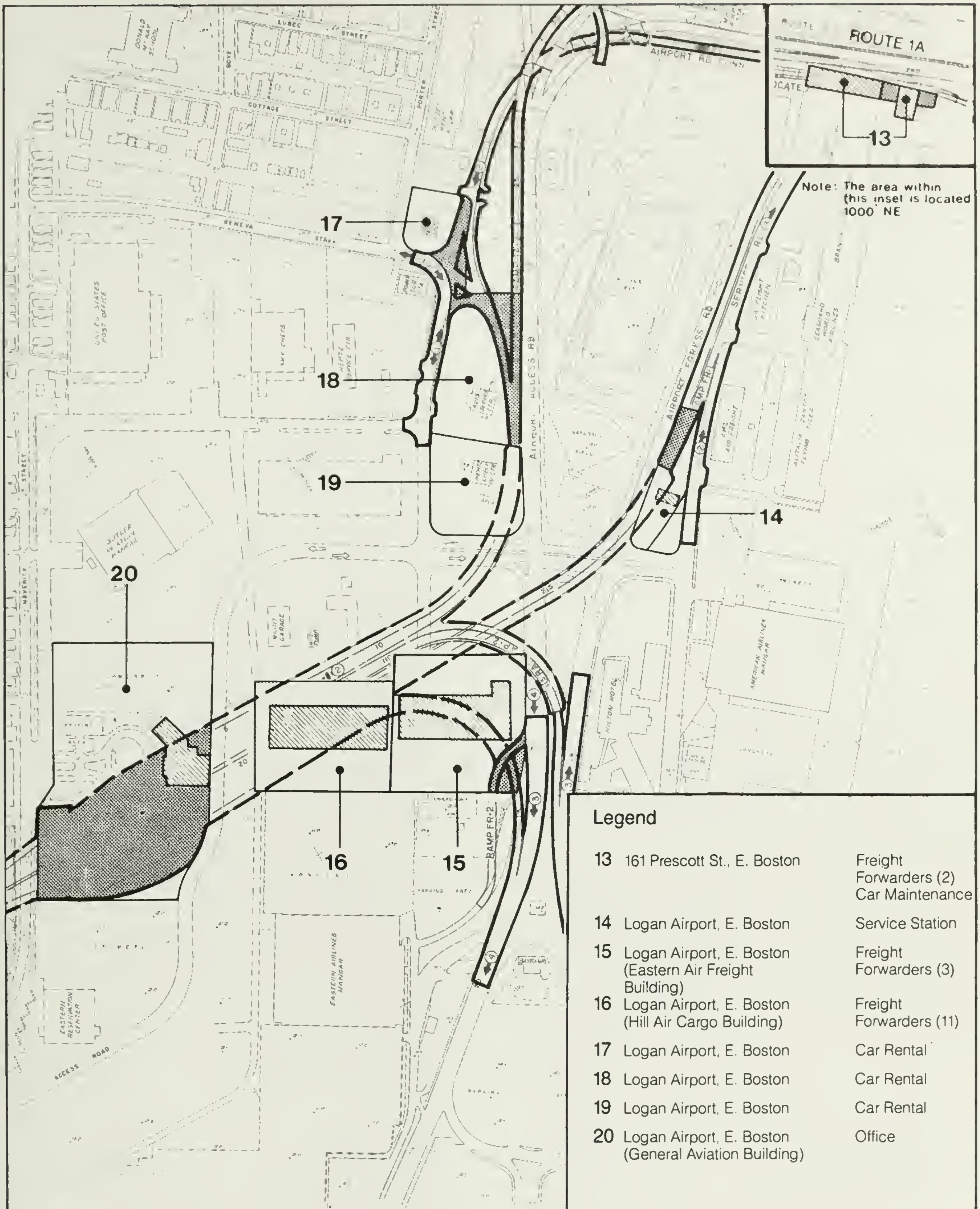
1	375 Broadway, Boston	Printer Warehouse
2	205 Bremen St., E. Boston	Travel Counter Office Car Rental
3	135 Bremen St., E. Boston	Freight Forwarder
4	125 Bremen St., E. Boston	Car Rental Parking
5	115 Bremen St., E. Boston	Parking
6	156 Maverick St., E. Boston	Courier
7	159 Maverick St., E. Boston	Auto Maintenance Parking
8	150 Orleans St., E. Boston	Paper Box Company
9	162 Orleans St., E. Boston	Car Rental
10	164 Orleans St., E. Boston	Car Rental
11	166 Orleans St., E. Boston	Car Rental
12	172 Orleans St., E. Boston	Wrought Iron Maker

Building Takings
Permanent Site Takings
Tunnel
New Roadway

Figure 35
Relocation Requirements Alternatives 2 & 4

Separate Scales for Each Diagram

EIS/EIR for I-90, The Third Harbor Tunnel



Legend

13	161 Prescott St., E. Boston	Freight Forwarders (2) Car Maintenance
14	Logan Airport, E. Boston	Service Station
15	Logan Airport, E. Boston (Eastern Air Freight Building)	Freight Forwarders (3)
16	Logan Airport, E. Boston (Hill Air Cargo Building)	Freight Forwarders (11)
17	Logan Airport, E. Boston	Car Rental
18	Logan Airport, E. Boston	Car Rental
19	Logan Airport, E. Boston	Car Rental
20	Logan Airport, E. Boston (General Aviation Building)	Office

Building Takings
Temporary Site Takings
Permanent Site Takings
Tunnel
New Roadway

Figure 36
Relocation Requirements Alternatives 3 & 5

0 100 200 400 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

airway facilities office. Businesses are 1 manufacturer, 1 warehouse, 16 freight forwarders, 3 car rental facilities, 1 car maintenance area, and 1 service station.

Alternative 4

With Alternative 4, no displacements will occur in Boston. In East Boston, relocations are the same as for Alternative 2.

Alternative 5

With Alternative 5, no displacements will occur in Boston. In East Boston and at Logan Airport, relocations are as for Alternative 3.

4.3.3 Comparable Space for Relocating Businesses

The availability of comparable space varies according to the type of business and its special relocation requirements.

Alternative 2

The warehouse and manufacturing business on the Boston side of the Harbor should be able to find suitable replacement space. The market is very active in Roxbury and South Boston, and space is also available in the immediate vicinity.

In East Boston, the folding box company and wrought iron business should be able to find relocation space close to their current sites, or in one of the nearby northern communities, based on current real estate market conditions. (Both businesses indicated that they could move out of East Boston, if comparable space were found elsewhere.) Both businesses currently have low monthly costs and will have to make thorough searches to satisfy their cost requirements.

Eight parking and car rental operations along the railroad right-of-way will have to find relocation space as close as possible to their current locations. One business, an automobile maintenance and parking facility, primarily serves users of the Maverick Square MBTA station, while the others primarily serve Logan Airport. Based on interviews with these businesses, their current location is ideal, in close proximity to the facilities they serve, easily accessible, and not requiring their customers to drive in heavy traffic. Comparable space in the same vicinity, however, is in short supply, and in most cases zoning changes or variances will be required for their relocation in the immediate vicinity.

Although one of the larger car rental agencies is considering relocating at the airport, rental space is substantially more costly at the airport, and it is unlikely that the smaller rental firms could relocate there. Sites for the airport-related businesses are available along Route 1A. Owners feel, however, that the Route 1A location is not as favorable as current sites: many customers would have to backtrack to get to the airport, the additional few miles would make shuttle operation more costly than at present, and this location would require driving in heavy traffic.

One freight forwarder located along the railroad right-of-way in East Boston will be relocated. This airport-related business has locational requirements similar to the parking and car rental operations, and locating relocation space in the immediate area will also be difficult. Freight handling space along Route 1A is more costly than in the present location for this business. This freight forwarder would prefer to minimize driving in heavy traffic on trips to the airport.

The travel service can probably be accommodated through a similar sub-lease arrangement with other off-airport parking or car rental businesses since they have small space

requirements (basically counter space).

A courier service and small real estate office should be able to be relocated to comparable space in Maverick or Day Squares.

Alternative 3

Relocation space for the warehouse and manufacturer in Boston has been discussed in Alternative 2.

Existing space at Logan Airport, although crowded, should be able to accommodate the relocation of the three car rental facilities at Logan Airport, based on current airport plans. Although takings will be partial, and in one case temporary, continued operation at the affected sites may not be feasible owing to reduced area and altered internal circulation. If these businesses were able to lease additional adjacent space to compensate for the land acquired by this alternative, relocation might not be required.

Sixteen freight carriers or forwarders, 2 located on property adjacent to Logan Airport and 14 on the airport grounds, will have to relocate. Sufficient site area at Bird Island Flats (BIF) will be available to accommodate these businesses (Massport plans call for 53,000 square feet of freight forwarding and 440,000 square feet of air cargo buildings to be available by 1987). Although two or three businesses indicated that they would consider relocating to BIF, costs to build or rent space in a new building there may be prohibitive for the other businesses. Estimates vary, but costs per square foot could range anywhere from 30 to 200 percent more than current costs.

While businesses not requiring airside access can relocate to land along Route 1A, they would lose the important qualities they had sought by moving to Logan Airport, including the airport address (which can be a competitive advantage) and the advantage of working with other businesses and customers at the airport (which is both convenient and can reduce the costs of doing business).

Although one air freight business indicated it would consider moving to Chelsea or Revere, these locations are less viable than their current location for businesses making numerous trips to Logan each day. According to one freight forwarder who previously relocated from the airport area to Chelsea, moving further from the airport required more frequent trips to the airport, resulting in increased fuel costs and personnel requirements.

An automobile maintenance facility operated by one of the car rental companies on property adjacent to Logan Airport can be replaced by a new facility on Route 1A. Relocation to existing space in Lynn may also be feasible.

FAA airway facilities personnel can relocate to Bird Island Flats although costs will be higher.

It will be difficult for the gasoline service station to find other comparable space at an airport egress location. (This is an important consideration because airport users tend to buy fuel upon leaving the airport, rather than before their airport business is completed.) A possible site would be just east of the Hilton Hotel, making the station accessible to drivers using the egress road for either the Sumner or Callahan tunnels, but this option would involve potential conflicts with other airport traffic.

It may be possible, however, for the service station to remain in place, although its activities would be considerably curtailed during construction (6 - 12 months). Upon completion of construction, the station can return to its current level of operation. The possibility of relocation, however, cannot be ruled out at this time, owing to uncertainty about the economic

feasibility of remaining in business while curtailing substantial business activities.

Alternative 4

There are no displacements on the Boston side of the Harbor for this alternative. For East Boston, see the previous discussion for Alternative 2.

Alternative 5

There are no displacements on the Boston side of the Harbor for this alternative. For required business relocations in East Boston, see the discussion for Alternative 3 for East Boston.

It is estimated that at least 18 months following property acquisition will be necessary to carry out a timely and orderly relocation program. This time period is necessary to enable some of the businesses to negotiate land purchases or leases and to build new facilities to necessary specifications.

4.3.4 Mitigating Measures

Relocation Assistance

A business relocation agent will be assigned by the MDPW to assist each relocating business in all phases of relocation and in the preparation of documentation required to process payment claims. The relocation agents will inform all business owners of their benefits and entitlements, courses of action which are open to them, any special provisions designed to encourage businesses to relocate within the city, and other public or private programs that may provide them with assistance.

Relocation Benefits

Depending upon the type of ownership and the business options chosen, displaced businesses are eligible for several payments:

1. Actual reasonable costs of moving.

2. Direct loss of tangible personal property for items that are not moved and cannot be sold.

3. Actual reasonable moving expenses in searching for a replacement business, up to $500.

4. A fixed payment in lieu of actual expenses, if the business does not relocate, up to $10,000.

In addition, there are several sources of public and private assistance which may have programs suited to the particular needs of a relocating business. These are discussed in Appendix 3: Conceptual Relocation Plan Report.

Functional Replacement

FHWA policies provide for functional replacement of publicly-owned facilities displaced by the project where this is demonstrated to be in the public interest. Functional replacement involves compensation beyond appraised market value of public property taken for highway projects, if replacement cost exceeds appraised value. In the context of relocation, functional replacement would apply to facilities at Logan Airport owned by Massport and taken by Alternatives 3 and 5.

4.4. LAND USE AND ECONOMIC IMPACTS

4.4.1 No-Build Alternative

Impacts of the No-Build Alternative are generally long term as no construction is involved.

The Region

Although difficult now at times, vehicular access to such regional attractions as Logan Airport from areas south and west of the area (particularly from downtown and adjacent districts) will be further reduced with the No-Build Alternative as traffic volumes and congestion increase. This inconvenience may marginally reduce growth in development potential in some areas as

compared to the build alternatives. Airport passenger and cargo volumes are not expected to be affected, and continued growth is likely.

South End

Development potential in the institutional/industrial area along Albany Street will be less under the No-Build Alternative than it will be under the build alternatives since access to the airport will not be improved. Property values are expected to increase gradually.

Industrial Triangle

The No-Build Alternative will not differ from the build alternatives in long-term effect; no major changes are foreseen, apart from the planned Amtrak service facility.

South Boston

Development potential of the northern, industrial, portion of South Boston will increase less under the No-Build Alternative as compared to the build options which improve access to the airport.

Fort Point Channel

Growth in development potential will continue but will be marginally less than under the build alternatives because airport access is not improved; three major properties which are specifically affected by the build alternatives will have substantially greater development potential under the No-Build Alternative because of the absence of highway ramp(s) at Summer Street and the ventilation building at Northern Avenue. New development and conversions of existing warehouses are expected and property values are anticipated to increase substantially.

Leather District

The No-Build Alternative will not contribute to beneficial change in land uses in this district which are somewhat retarded by through traffic. Development potential may be slightly less than under the build alternatives which improve access to the airport. Gradual conversion of buildings to higher uses is expected.

Chinatown/South Cove

Traffic on Kneeland and Beach Streets will continue to hinder circulation within this district to the detriment of local land uses. Some institutional and residential redevelopment is likely to occur.

Financial District

No significant effects on this district are expected under this alternative. Continued development and increases in property values are expected.

Waterfront

There are no significant effects on land uses expected in this district with the No-Build Alternative. Redevelopment of this area is nearly complete.

North End

Cross-harbor traffic will have increasing adverse effects on residences and businesses, primarily on Cross and Hanover Streets and surrounding the tunnel portals. Residential property values are expected to continue to increase.

East Boston

Impacts related to cross-harbor traffic will continue to increase on the streets serving the existing tunnels. Land use conflicts will continue on portions of Bremen and Orleans Streets where residential and airport-related land uses are located in close proximity. Demographic changes, including an increased average age of the resident population, may increase the seriousness of these problems in the localized areas cited; the No-Build Alternative will exacerbate these problems near the existing tunnels but

will have less impact in the localized areas of Bremen and Orleans Streets near Porter Street.

Logan Airport

Growth in passenger and air cargo volumes will be the same for the No-Build Alternative and the build alternatives, but airport revenues from automobile parking and land development will grow less under the No-Build Alternative (see discussions below under Alternatives 2 and 3).

Route 1A North

The commercial development potential of land with highway frontage will increase less under the No-Build Alternative than with the build alternatives. Some airport-related and other commercial and industrial development is possible on vacant sites.

4.4.2 Alternative 2

The Region

Long-term impacts of the proposed construction on the region will include a net gain in employment in downtown Boston as firms voluntarily locate there, owing to improved access to the airport. The decrease in short-term tax revenues may be offset in the longer term by accelerated new development resulting from regional improvements in access; this tax benefit may be up to $800,000 per year (based on 1982 assessments and tax rate), assuming that all development stimulated by the project would not occur elsewhere in Boston.

Construction impacts on the region will have two economic manifestations: temporary business losses as a result of lost or reduced access, and significant increases in employment in construction and related industries. An estimate of short-term economic impacts of Alternative 2 are as follows:

Net tax revenues to the City of Boston will decrease slightly as a result of land takings (approximately $170,000 per year at 1982 assessments and tax rate). On-site construction employment is estimated at 4,800 person years. (Boston residents are estimated to occupy 24 percent of these jobs.) Off-site employment (e.g. in construction materials manufacturing) is estimated at 500 person years in Massachusetts and 15,500 person years elsewhere in the United States, including indirectly induced employment. Direct labor expenditure (i.e., wages and benefits) is estimated at $266,000,000.

South End

Long-term impacts on the South End industrial area will be positive, owing to improved access to the airport for high-tech industries and developments. The overall long-term effect on property values and tax revenues would be small but positive, possibly on the order of five percent, (an annual tax revenue increase of $107,000, based on 1982 assessed values and tax rate).

Construction impacts on the South End will be the result of increased traffic on Albany Street between Herald and East Berkeley Streets when the West Fourth Street Bridge is closed by construction and reduced width of access ramps to the Southeast Expressway. The disruption in access will not be long enough in duration to affect land use.

Industrial Triangle

Long-term impacts are not likely; any changes will be positive owing to improved access to downtown and Logan Airport via new Dorchester Avenue.

Construction impacts will result from congestion on Frontage Road on the industrial section of Dorchester Avenue. Firms with marginal levels of business could be significantly affected when access is impaired during construction, and vacancies may occur. Business losses cannot be estimated with certainty,

but may be up to $15 million, according to the truck-oriented businesses which will be affected by detours.

South Boston

Long-term impacts on the northern industrial area will be positive, owing to improved access to the airport and points north and improved access from the south via the new Dorchester Avenue.

Construction impacts will include congestion caused by increased traffic, both in the northern industrial area and in the southern residential area. In the northern area, the temporary narrowing of the Summer Street and Congress Street Bridges, temporary closing of Congress Street, and some accompanying traffic congestion will impair access and could temporarily slow the redevelopment. Sales at the commercial establishments and restaurants along the piers may also decline. In the southern area, the small stores near Broadway and Andrew Square may be similarly affected.

Fort Point Channel

Long-term impacts include increased accessibility to Logan Airport and the North Shore, improving development potential for parcels and renovated areas not adversely affected. These effects will probably not be singularly decisive to the area's future, however. Overall property values and tax base may increase by five percent or more owing to the new tunnel, representing net tax revenue increases of approximately $700,000 per year, based on 1982 assessments and tax rate.

The presence of new Dorchester Avenue between existing Dorchester Avenue and Northern Avenue may alter currently planned recreational use such as marinas, waterfront restaurants, and use of waterfront park areas. The Channel area will be adversely affected by visual/aesthetic impacts (see Section 4.15), but these impacts would probably not be sufficient to significantly impede commercial office development in most locations; the circulation improvements represented by this roadway will benefit development not adjacent to this segment of the Channel.

The viaduct ramp at Summer Street will have visual impacts on immediately adjacent buildings and on the large, vacant Rose Associates parcel south of Summer Street. Since visual access to the Channel waterfront is a major aspect of the rental value of this property, these impacts may be sufficient to retard or prevent office, commercial or residential development from occurring on the vacant parcel, limiting its highest use to industrial development. Conversion of the lower floors of existing structures south of Summer Street may be similarly affected. Under current zoning, which permits commercial structures of up to eight stories, the loss to the Rose parcel's owners may be 90 percent of its total value; based on the 1982 tax rate and assessed value, the unrealized potential tax revenue from development possibly precluded by the ramps might be on the order of $500,000 per year. However, if zoning were to be changed to permit high-rise construction, e.g. 15 stories or more, on the Rose parcel, economic and tax revenue impacts due to the ramps would probably not be significant.

The connection to the northbound Central Artery will cross under a corner of the highly constrained Boston Edison parcel; this factor might be decisive in limiting its development potential. The tunnel connection under the Foster's Wharf development site will increase development costs, for which compensation will be paid in the subsurface taking. This compensation, which is included in the project cost estimate, should be sufficient to offset any impact on development potential.

The ventilation building at

Northern Avenue will affect land use to the extent that it affects views significant to waterfront development potential. The greatest effect will be on the potential future redevelopment of the Hook Lobster parcel and, to a lesser degree, the Boston Edison parcel, possibly limiting their future development to industrial use and reducing land values by as much as 90 percent. Economic impacts will also be caused by the ventilation building on the Harbor Plaza Building and possibly the Bain Building, but while these impacts might affect potential property values, they will probably not involve land use changes.

Increased traffic on Atlantic Avenue may reduce the market potential for mid-rise residential development on parcels such as Rowe's Wharf.

Construction impacts on the Fort Point Channel area involve temporary construction disruption caused by barges in the Channel and construction equipment along Dorchester Avenue, Summer Street, Congress Street, and Northern Avenue; and congestion on these streets and Atlantic Avenue due to temporary Fort Point Channel bridge constrictions and Central Artery ramp closings. This may temporarily discourage the development of office space during the construction period and cause business losses to restaurants on the South Boston side of the Channel, to the Tea Party Museum, and to a lesser extent, to the Children's Museum.

Tunnel connections to the northbound Central Artery will displace approximately 100 parking spaces on the Edison property. The connection to the southbound Central Artery will cross under the Foster's Wharf development site, causing delays in development through 1990 or beyond.

Estimated business losses due to delays and reduction of access in the Fort Point Channel area are approximately equal to $166,000-$322,000 per month of construction in this area, depending on the percentage of sales lost.

Mitigating Measures to reduce long-term land use and economic impacts in the Fort Point Channel area are generally urban design and joint development improvements; they are described in Section 4.15.7.

Leather District

Long-term impacts are likely to be beneficial owing to projected decreases of through traffic in the District.

Construction impacts on land use in the Leather District will consist of construction traffic and disruption, causing delays in development activity.

Chinatown/South Cove

Long-term impacts will be beneficial as a result of decreased traffic on Kneeland Street. Decreased traffic will improve pedestrian access to the commercial, residential, and institutional areas, thus reducing barriers between related uses.

Construction impacts in this area will be caused by reduced access during the construction period; this might affect restaurant and tourist trade activity in the area.

Financial District

Long-term impacts will be mixed. Removal of the High Street exit ramp will benefit a major proposed office development in the Fort Hill area.

Access to the Financial District from the Massachusetts Turnpike will be reduced by the removal of exits from the Central Artery to downtown streets between Kneeland Street and North Station, but access to Logan Airport will be improved because of direct access to the Third Harbor Tunnel via the Summer Street ramp. Vehicular circulation between the Financial District and the Waterfront and Fort Point Channel

areas will be more circuitous as a result of relocating the turnaround between Atlantic Avenue and Purchase Street, and owing to increased traffic on Summer Street (AM only), Congress Street, and Atlantic Avenue. This may decrease the ease of interaction between these areas and reduce the speed with which the Financial District land uses expand towards the Harbor.

Construction impacts on the Financial District will include traffic disruption and congestion. The land uses in this area are not particularly sensitive to such impacts, and the principal short-term effect will be inconvenience. Only minor business sales losses are expected.

Mitigating measures include the provision of a pedestrian overpass between Fort Point Channel and the Financial District and clear signage directing drivers from Atlantic Avenue to the Financial District.

Waterfront

Long-term impacts on the Waterfront will be beneficial as a result of reduced congestion on streets serving the existing tunnels.

Construction impacts on the Waterfront will result primarily from circulation and congestion problems on Atlantic Avenue, Surface Artery, and Central Artery ramps during construction. This may inconvenience residents of Harbor Towers and patrons of Waterfront businesses. Certain businesses, such as the harbor cruises, could be significantly affected.

Mitigating measures for the Waterfront include traffic management tools and a system of construction period signing to provide orientation for tourists and other infrequent visitors to the area. During peak tourist season, special provisions may be required to direct traffic and insure the safety of pedestrians as they walk between Waterfront attractions such as Faneuil Hall and the Aquarium.

North End

Long-term impacts will be positive and will result from reduced traffic using the Callahan and Sumner Tunnels. Environmental quality for pedestrians using Cross Street should improve both in terms of traffic safety and due to reductions in air pollution, noise and vibration. These improvements could enhance business activity along Cross Street and along the first block of Hanover Street.

Construction impacts on North End land uses and economic activity may occur as a result of increased traffic on Commercial Street as motorists seek to enter the Central Artery at North Station while the ramp from Atlantic Avenue at Northern Avenue is closed. This increased traffic may adversely affect restaurants and retail activities along Commercial Street, particularly those that are heavily used during peak traffic periods such as Bay State Lobster.

East Boston Neighborhoods

Long-term impacts will include a shift in use of approximately 5.4 acres from commercial and industrial use to permanent roadway and toll plaza use in and adjacent to the railroad right-of-way. As discussed in Section 4.3, 16 businesses will be permanently displaced. Since little suitable land will be available for relocation of the existing businesses, there will be pressure on any existing vacant parcels to shift to airport-related uses, such as car rental or freight forwarding, and commercial land values will increase.

The toll plaza between Bremen and Orleans Streets is likely to be perceived as inconsistent with the adjacent residential land uses. This long-term effect, which is compounded by short-term construction disruption, may lead to longer turnover times for apartments vacated during the

construction period, possible increases in total vacancies, and possible reductions in value of the properties and dwellings in the localized area.

Since the total land area available for airport-related uses under current zoning will be significantly reduced by the project, pressure will increase on properties near the airport to convert from residential to industrial use, particularly land near Porter Street, which will have good access to both the airport and the existing tunnel, but also land in the Day Square area. Zoning currently precludes such conversions.

The land lying between Route 1A and Bremen Street, north of Porter Street, is currently occupied by long-term, off-airport parking lots. Rental car facilities generate greater revenues than long-term parking; therefore, this area may also tend to change to car rental use if the existing car rental facilities are displaced by the project, potentially offsetting pressure on residential land, but increasing pressure for space for long-term parking lots.

If the small rental car agencies which will be displaced by the project can not find appropriate replacement space, they will probably go out of business. There will also be economic impacts on businesses not themselves displaced but serving the displaced firms, particulary automobile repair businesses for which the car rental firms are principal customers. The large national companies located on-airport will probably assume the business of these displaced companies.

Land in the railroad right-of-way south of the toll plaza will be improved and continue to function as possible open space; surface grades will be modified and the existing rail line will be relocated within the right-of-way.

The ventilation building may be visually incompatible with the types of residential and commercial development proposed for the Massport piers and NDP II development sites, and might contribute to continued vacancy of the land or its development for industrial use.

The project will have positive long-term effects on residential land use in parts of East Boston outside the immediate project area. Improved access to Boston and reduced traffic on Bremen, Chelsea, and Porter Streets and part of Bennington Street will increase the attractiveness of parts of the neighborhood as a location for housing. This could gradually lead to increased reinvestment in the housing stock of East Boston which is at some distance from the project.

<u>Construction impacts</u> will include changes in land use in the right-of-way and in construction staging areas. For a period of three years, some of the vacant land area at the Massport piers may be occupied by construction-related uses. This short-term land use and construction disruption may delay pier development, such as at the NDP II site.

The sequential closing of the bridges across the right-of-way (Sumner, Maverick and Porter Streets) will slightly increase commuting distance between Jeffries Point and other locations; however, because temporary crossings will be provided, three crossings will be maintained. These delays will not be significant and will not have land use or economic impacts on the area. The changing of traffic routes because of the bridge closings will cause shifts in the level of traffic on local streets which have adequate capacity to serve projected volumes without undue congestion.

Construction-related traffic will be restricted to a haul road within the railroad right-of-way which will minimize overall changes in traffic on local streets to the extent possible. Land use and economic activities will not be significantly

affected in the short term except for the relocated businesses within the right-of-way.

Mitigating measures which can be taken to reduce specific impacts in localized areas, include restricting all tunnel and construction-related traffic to the extent possible from local streets to reduce noise, dirt and disruptions in these neighborhoods.

Closing Porter Street access to the airport could help to mitigate commercial development pressures on residential property, but would itself involve further business impacts and interfere with local trips to the airport. This measure will not in itself mitigate direct localized impacts on residential property near the proposed toll plaza.

Section 4.15.7 describes urban design and joint development mitigating measures which address visual and development issues along the railroad right-of-way.

Logan Airport

Long-term impacts will include improved access to Logan Airport, which will be generally beneficial to its principal functions of passenger and air-cargo transport. This improved access will also be a benefit to the Bird Island Flats mixed-use development. Access improvements will also lead to some induced traffic, i.e., an increase in automobile trips related to air travel and airport employee commuting owing to mode switch and increased drop-offs; no induced increase in air travel is anticipated since few air travel decisions would be affected by the travel time to the airport. One effect of induced traffic will be to increase the demand for airport parking. There is adequate land area on the airport to accommodate these automobile-related land uses at locations consistent with the Logan Airport Master Plan, which provides for a 120 percent increase in traffic over the period addressed by the plan.

Construction impacts will not directly affect airport land uses, except for a small taking at one car rental site. Relocation of airport-related car-rental and freight-forwarding businesses from the East Boston community may increase demand for on-airport facilities to a limited extent, either through relocation of one or more businesses to the airport or through increased shares of business by firms already located on-airport.

Route 1A North

Long-term impacts on the area will be predominantly positive. Some displaced airport-related businesses may attempt to relocate to this area. Increased traffic on Route 1A could be beneficial to businesses which depend on good access and to highway-oriented commercial businesses.

Impacts on land use in Revere will be minor, with some increase in business expected because of improved access from Boston and the South Shore.

Construction impacts on land use in this area will be minimal.

4.4.3 Alternative 3

The Region

Overall impacts on the region are similar to those described under Alternative 2 except in the projections of construction period employment and tax revenue. These are summarized below.

On-site construction employment is estimated at 5,100 person years. (Boston residents are expected to occupy 24 percent of these jobs.) Off-site employment is estimated at 730 person years in Massachusetts and 16,300 person years elsewhere in the United States, including indirect stimulation of employment. Direct Labor Expenditure is estimated at $281,000,000.

Alternative 3 is identical to

Alternative 2 on the Boston side of the harbor; therefore, it will have identical construction period and long-term land use and economic impacts in the South End, Industrial Triangle, South Boston, Fort Point Channel, Leather District, Chinatown/South Cove, Financial District, Waterfront and North End areas. Net tax revenues to the City of Boston will decrease during construction by approximately $125,000 per year, based on 1982 assessments and tax rate. Long-term tax revenues may increase as indicated under Alternative 2, above.

East Boston

Long-term impacts will be beneficial for the residential community in East Boston. There will be reduced traffic levels at the Callahan/Sumner tunnel toll plaza, reduced traffic on Bremen, Chelsea, Porter, and part of Bennington Streets, and improved access between East Boston and downtown. Air quality will be improved over a broad area. These factors could increase the attractiveness of the neighborhood for residential and related retail development.

Construction impacts of Alternative 3 on the East Boston neighborhood will not be significant since the alignment is essentially confined to airport property.

Logan Airport

Long-term impacts are as follows: two car rental firms will lose portions of their sites, requiring them to lease additional space or to relocate; the existing Edson General Aviation Building (most of whose present tenants are to be relocated by 1987) will be removed and 69,675 square feet of associated parking and aircraft apron will be occupied by a new toll plaza, a tunnel administration building, and a ventilation building. There will be a net loss to Massport of 128,375 square feet of leaseable land area for which compensation will be paid. Ample area exists to accommodate the relocated facilities on BIF and elsewhere in airport support areas. Other beneficial long-term impacts attributable to induced traffic are similar to those described under Alternative 2.

Construction impacts will involve the temorary taking of several sites in addition to those permanent takings described above. Partial temporary takings will involve two additional car rental sites: one of the affected companies indicated that operation would not be possible during tunnel construction, while the other anticipated that relocation would be undesirable despite inconvenience and possible loss of business due to the construction. Current revenues at these car rental firms are estimated at $25,000 per day; the proportion of this business that would be temporarily lost cannot be estimated with accuracy.

The Eastern Airlines air freight building and Hill Cargo Building will be demolished, requiring relocation of the businesses, but new construction will be necessary to accommodate most of them; some of the businesses may be able to relocate to vacant space in other air freight buildings at the airport. Based on estimated building costs and anticipated site and building rents at the Bird Island Flats cargo area now under development at the airport, there would be a substantial increase in facility costs for the firms moving to newer facilities. The two air freight buildings are currently leasehold improvements owned by Massport's ground lease tenants; the buildings will revert to Massport upon termination of the ground lease. Replacement of the buildings is estimated to cost approximately $1.5 million each at current prices, exceeding the estimated current value of the buildings. The air freight building sites will be structurally adequate to support similar buildings following tunnel construction. However, it is unlikely that the relocated businesses would return to

their original sites after tunnel construction is completed.

An automobile service station building will be removed and its site partially taken during construction. It will be physically possible for gasoline sales to continue during construction but unclear whether this would be economically feasible; if not, relocation will be necessary. The service station can be replaced following construction.

Roadway changes during construction will reduce convenience for air travelers and airport businesses, but do not constitute a significant economic impact. Service road changes may require modifications to the fuel offloading procedures of Eastern Air Lines.

Mitigating measures include the construction staging assumptions described in Section 4.1. The staging assumptions provide that airside operations will not be disrupted by construction, that the BIF access road will remain open at all times, and that the existing number of lanes in the main airport roadway will be maintained at all times. There is sufficient land at the airport to stage construction to minimize impacts on airport operation.

Route 1A North

The impacts of Alternative 3 on Route 1A North are the same as those identified previously for Alternative 2.

4.4.4 Alternative 4

The Region

The regional impacts of Alternative 4 are similar to those of Alternative 2 except in the projections of construction period employment and tax revenues. On-site construction employment is estimated to be 4,100 person years. (Boston residents are expected to occupy 24 percent of these jobs.) Off-site employment is estimated to be 510 person years in Massachusetts and 12,700 person years elsewhere in the United States, including indirectly stimulated employment. Direct Labor Expenditure is estimated to be $224,000,000.

Boston and East Boston

The land use and economic impacts of Alternative 4 on the South End, Industrial Triangle, South Boston, Leather District, Chinatown and North End are similar to those of Alternative 2 as described previously. They are identical to Alternative 2 impacts in East Boston, Logan Airport, and Route 1A North. There are no impacts on the Financial District and Waterfront. Net tax revenues to the City of Boston will decrease during construction by approximately $110,000 per year, based on 1982 assessments and tax rate. Long-term tax revenues may increase as indicated under Alternative 2.

Fort Point Channel

Long-term impacts of Alternative 4 on development in the Fort Point Channel area will be similar to those described for Alternative 2. Access to the airport will be somewhat better than for those alternatives because there will be both an entrance and an exit to the tunnel at Summer Street. Overall property value and tax base increases may be on the order of five percent or $700,000 per year, based on 1982 assessments and tax rate.

The economic impacts resulting from visual impact on the vacant Rose Associates parcel and existing loft buildings south of Summer Street will be more significant than for Alternatives 2 or 3 due to the presence of two higher and longer viaduct ramps, making adverse effects on long-term use (as described for Alternative 2) more likely.

Construction impacts and Mitigating measures are as described

in Alternative 2.

4.4.5 Alternative 5

The Region

The impacts on the region are the same as those for Alternative 2, except as follows. On-site construction employment is estimated to be 5,100 person years. (Boston residents are expected to occupy 24 percent of these jobs.) Off-site employment is estimated to be 725 person years in Massachusetts and 16,000 person years elsewhere in the United States, including indirectly stimulated employment. Direct Labor Expenditure is estimated to be $280,000,000.

Boston and East Boston

The land use and economic impacts of Alternative 5 are identical to Alternative 4 for the South End, Industrial Triangle, South Boston, Fort Point Channel, the Leather District, Chinatown/South Cove, the Financial District and the Waterfront, North End, and Route 1A North, all as described previously. The impacts are identical to impacts of Alternative 3 for East Boston and Logan Airport because this portion of the alignments are identical.

Net tax revenues to the City of Boston will decrease during construction by approximately $70,000 per year, based on 1982 assessments and tax rate. Long-term tax revenues may increase as indicated under Alternative 2, above.

4.5 NEIGHBORHOOD AND COMMUNITY FACILITIES

4.5.1 Introduction

The five alternatives will have different effects on neighborhood characteristics, cohesion, community image, and quality of life in the project area. These effects are determined by evaluating changes in travel patterns and accessibility to community facilities and shopping areas, as well as by examining secondary effects of transportation, land use, air quality, noise, and visual impacts.

4.5.2 No-Build Alternative

See Section 3.3 for a presentation of demographic trends and neighborhood characteristics which are expected under the No-Build Alternative.

In the South End, long-term neighborhood characteristics will be substantially the same under No-Build and build alternatives. In South Boston and Chinatown, through traffic under the No-Build Alternative will have some adverse effect on quality of life. In East Boston, the large proportion of elderly residents in East Boston, coupled with a rising vacancy rate (already higher than the Boston average), indicates that the area will experience considerable demographic change over the next 20 years, making the community sensitive to changes which affect neighborhood cohesion, as well as the character of the community. Under the No-Build Alternative, traffic increases in the existing tunnels and airport growth will tend to increase traffic and related impacts in East Boston residential areas abutting the existing tunnels and the airport. Noise levels related to traffic will increase, and while air quality improvements due to federal emission controls are expected, pollutant concentrations will be near or above standards at several locations, reducing the quality of life in these areas and increasing the probability of disinvestment and associated community impacts. Land use conflicts between airport-related and residential uses may also tend to impede neighborhood preservation efforts in localized areas.

4.5.3 Alternative 2

South End

Long-term impacts on community facilities in the South End will not

be affected. Intrusions into residential areas will not be greater than under the No-Build Alternative. Rotch Playground will not be affected.

Construction impacts of Alternative 2 will have little effect on community facilities and neighborhood cohesion in the South End. Some traffic increases are likely on East Berkeley Street during construction, marginally reducing quality of life.

South Boston

Long-term impacts such as residential vacancies in the area west of D Street may be sufficient to influence the success of attempts to stabilize housing and improve the community, such as the on-going rehabilitation of the D Street Housing Project. After the construction period, northbound morning traffic on L Street and afternoon northbound traffic on D Street will increase; the affected streets may become less attractive places to live because of these traffic increases.

Construction impacts are expected to occur in residential South Boston during the construction period. Dorchester and Old Colony Avenues, and A, B, and D Streets will experience traffic increases as a result of sequential bridge closings, detours, and disruption on the Central Artery and Frontage Road. Increased traffic at the Broadway/Dorchester Avenue intersection may affect access to several key community facilities including Saint Peter and Paul Roman Catholic Church and the Cardinal Cushing High School for Girls, and traffic on D Street may similarly affect the Condon Community School. Traffic will be heavy near the MBTA Red Line Broadway and Andrew Square Stations, both of which are key community facilities. The quality of life will be adversely affected on the residential streets which experience an increase in traffic, noise, and air pollution, and currently high residential vacancy rates may increase.

Mitigating measures include traffic management and construction Staging to minimize detours (Section 4.1).

Chinatown/South Cove

Long-term impacts due to traffic reductions on Kneeland Street will improve conditions for residents and visitors and could lessen the feeling of overcrowding. Air quality at Tai Tung Park on Kneeland Street will be improved, benefitting this community facility.

Construction impacts include congestion on Kneeland Street which may have adverse effects on the community. This major neighborhood and city artery is used by area residents and employees, and by clients of Tufts New England Medical Center. Pedestrian safety and general environmental quality may be somewhat diminished by increased traffic congestion.

East Boston

Long-term impacts of the project include a public health benefit due to reduced air pollutant concentrations compared to the No-Build Alternative over a wide area; the greatest improvement will occur in the areas of existing highest concentrations (see Section 4.6).

As indicated in Section 4.2, traffic volumes will decrease substantially along Porter, Bremen, and Chelsea Streets and part of Bennington Street. Residential quality of life will benefit both from decreases in traffic related impacts and from decreased commuting times between East Boston and downtown Boston. Local vehicular and pedestrian access will improve as a result of the overall reduction in non-residential traffic on local streets. These improvements in accessibility should enhance the quality of life for residents spatially removed from the toll plaza and ventilation building, particularly

along Porter Street between Central Square and the existing Callahan/Sumner toll plazas.

Alternative 2 will also have adverse community impacts which will be localized around the project right-of-way. These impacts are primarily related to land use but represent adverse changes affecting quality of life and neighborhood preservation efforts; projected demographic changes (e.g., high proportion of elderly and high vacancy rate) make the area sensitive to these impacts, which are described below.

The broadest adverse impact is due to the effect on the perceptions of both residents and visitors that the East Boston area, from Central Square to the airport, is transportation oriented rather than a residential area. This image may offset tangible improvements in air quality and traffic circulation and thereby discourage new households from locating in the area, a necessary element in maintaining community cohesion. The effect on neighborhood image may also discourage waterfront development regarded as beneficial to community preservation.

In the corridor extending from the proposed toll plaza along Bremen Street to Day Square, there may be pressure for rezoning to permit conversion of land to airport-related commercial uses, several of which will be displaced by the project. If such pressures are realized as land use changes, neighborhood preservation could be adversely affected in this corridor.

In the localized area surrounding the proposed toll plaza, visual impacts and land use conflicts between the transportation facilities and abutting residences will have an adverse impact on the housing stock, reducing quality of life for the residents of Bremen Street and Orleans Street south of Porter Street and possibly leading to increased vacancies and neighborhood disinvestment. The project will not require acquisition of residential property. Bremen Street will be narrowed and become one-way from Porter to Maverick Street, which may be regarded as a benefit to some residents and as an inconvenience to others (alternatively, if the sidewalk adjacent to the tunnel structure is replaced with a 2' safety walk, two-way traffic could be maintained). The wall proposed to screen Bremen Street from the relocated below grade railroad track will visually separate Jeffries Point from the Central/Maverick neighborhood, reducing community cohesion.

There will be a taking of some parking from the East Boston Memorial Stadium property although access and recreational facilities will be unaffected (see Chapter 5.0). New passive open space will be created in the railroad right-of-way south of the proposed toll plaza.

Construction impacts will reduce quality of life and neighborhood cohesion along the right-of-way, although access between the Jeffries Point and Central/Maverick neighborhoods will be maintained. Residents in these neighborhoods depend on facilities and services located on both sides of the proposed right-of-way. The sequential staging of bridge reconstruction across the railroad right-of-way and provision of temporary crossings will ensure that vehicular access between the two neighborhoods is maintained, although it may be somewhat more circuitous. Pedestrian crossings will be maintained at each existing bridge. Construction period traffic can be carried by the surrounding street system without congestion. Police and fire protection will not be adversely affected.

South of Gove Street on the east of the right-of-way and south of Bremen Street on the west of the right-of-way, the area adjacent to the construction site is primarily residential. The potential use of streets for construction workers' parking would inconvenience

neighborhood residents. Vibration, noise, and dirt from construction activity, and the hauling of construction materials could affect the qualify of life for all residents including the large elderly populations at Heritage Apartments and Victory Gardens Apartments. These adverse construction period effects may also hamper ongoing community efforts to control residential vacancy rates.

Mitigating measures include construction staging as described previously. Additionally, slurry wall construction techniques will be employed wherever possible from the Massport piers to Gove Street. This method of construction requires a narrower right-of-way and can be done more quietly than other techniques. Workers' parking will be provided in the construction staging area to minimize community disruption, and construction traffic will be limited to a haul road within the right-of-way connecting directly to and from Route 1A, to the extent possible.

4.5.4 Alternative 3

The impacts on neighborhood and community facilities for Alternative 3 are identical to those for Alternative 2 in the South End, South Boston and Chinatown/South Cove (see Section 4.5.3).

East Boston

Long-term impacts are expected to be beneficial except for perimeter impacts to East Boston Memorial Stadium (discussed below).

There will be a significant improvement in air quality, and traffic will be reduced on a number of East Boston streets to approximately the same degree as in Alternative 2. Residences adjacent to the existing toll plaza will benefit from reduced air and noise pollution as a result of a decrease in congestion at the Callahan/Sumner Tunnels. These traffic improvements will also reduce the commuting time from East Boston to Boston. Changes in the residential image of East Boston, and increased pressure from airport-related commercial uses as described under Alternative 2 will not occur with Alternative 3. These effects should improve the overall quality of life for most residents of East Boston.

East Boston Memorial Stadium will be marginally reduced in area and permanently affected in three locations as discussed in Chapter 5.0. Air quality at the Stadium will be significantly improved relative to the No-Build Alternative; noise levels at the Stadium will not be significantly changed (see Sections 4.6 and 4.7.).

Bird Island Flats Park will experience no long-term impacts.

Construction impacts in East Boston will be confined to the East Boston Memorial Stadium and the proposed Bird Island Flats park; impacts are described in Chapter 5.0. There will be no significant construction period effects on noise and air quality at Porzio Park.

Mitigating measures for these properties in East Boston are discussed in Chapter 5.0.

4.5.5 Alternative 4

The community impacts of Alternative 4 on South Boston and East Boston are the same as for Alternative 2 (see Section 4.5.3).

South End

Long-term impacts will not be significant.

Construction impacts will be marginally greater than for Alternatives 2 and 3 owing to construction of a new viaduct ramp opposite Rotch Playground causing moderate to minor noise impacts along this portion of Albany Street (See Section 4.7). The traffic-related effects in residential areas will not be significantly different than under

Alternative 2.

Mitigating measures include incorporation of measures to reduce construction disruption to Rotch Playground (see Section 4.1).

South Boston

Long-term impacts are similar to Alternative 2, except that traffic-related impacts on L and D Streets will not occur and there will be a minor reduction in noise levels at St. Peter and Paul Church relative to the No-Build Alternative (see Section 4.5.3).

Construction impacts are similar to those in Alternative 2; see Section 4.5.3.

Chinatown/South Cove

This alternative has no significant impacts on the Chinatown/South Cove community.

East Boston

Impacts for Alternative 4 on East Boston are the same as for Alternative 2 (see Section 4.5.3).

4.5.6 Alternative 5

Impacts of Alternative 5 are the same as for Alternative 4 in the South End, South Boston, Chinatown/South Cove, and Waterfront/North End (see Section 4.5.5); and the same as for Alternative 3 in East Boston (see Section 4.5.4).

4.6 AIR QUALITY

This project is in an air quality nonattainment area which has transportation control measures in the State Implementation Plan (SIP) which has been reviewed by the Environmental Protection Agency (draft submitted on June 15, 1982). The FHWA has determined that both the transportation plan and the transportation improvement program conform to the SIP. The Federal Highway Administration has determined that this project is included in the transportation improvement program for the Metropolitan Area Planning Council area. Therefore, pursuant to 23 CFR 770, this project conforms to the SIP. Since the project conforms to the SIP, a mesoscale air quality analysis is not required from the Federal standpoint. It has been performed as part of this study due to State (Massachusetts Department of Environmental Quality Engineering) requirements.

Appendix 5 contains more detailed information regarding the air quality analysis, including monitoring data and modeling information.

4.6.1 No-Build Alternative

Existing Conditions

Emissions

Using existing 1982 24-hour traffic volumes on the affected roadway network in the project area, emissions of carbon monoxide (CO), oxides of nitrogen (NO_x), and non-methane hydrocarbons (NMHC) from all motor vehicle sources were estimated for the baseline (existing) conditions. The results, as presented in Table 38, indicate that on an average day in 1982 motor vehicle sources in the project area were estimated to emit 55,100 kilograms (Kg) of CO, 5890 Kg of NO_x, and 3860 Kg of NMHC.

CO levels

CO concentrations at selected receptor locations in the project area, including Bell Circle in Revere, were estimated to determine the effects on these concentrations under baseline conditions. The receptors that were selected for the analysis are listed in Table 39. Estimates of the maximum 1-hour CO concentrations at these receptors under 1982 conditions are shown in Table 39.

The maximum 1-hour CO concentrations in 1982 were estimated

Table 38

TOTAL 24-HR EMISSIONS OF CARBON MONOXIDE, OXIDES OF NITROGEN, AND NONMETHANE HYDROCARBONS FOR VARIOUS ANALYSIS YEARS AND PROJECT ALTERNATIVES, IN KILOGRAMS

Analysis Year	Alternative	Pollutants CO	NO_x	NMHC
1982	1	55,100	5890	3860
1990	1	36,800	4240	1680
	2	35,600	4220	1610
	3	34,800	4160	1580
	4	35,100	4310	1710
	5	34,400	4250	1680
2010	1	33,700	3860	1430
	2	31,600	3870	1350
	3	30,100	3760	1380
	4	28,600	3890	1400
	5	27,700	3790	1350

Table 39

ESTIMATED MAXIMUM 1-HR CARBON MONOXIDE CONCENTRATIONS* AT SELECTED RECEPTOR LOCATIONS FOR VARIOUS ANALYSIS YEARS.

	Receptor Locations	1982	1990					2010				
		Existing	Alternatives					Alternatives				
			1	2	3	4	5	1	2	3	4	5
1.	Rotch Playground	16	13	12	12	11	11	10	11	11	9	9
2.	Columbus Park	9	5	4	5	5	5	4	4	4	4	3
3.	Residence-Dorchester Ave.	10	7	5	6	6	6	6	5	5	5	5
4.	Broadway Station	10	7	5	6	5	5	5	5	5	5	4
5.	Tea Party Ship	12	10	7	8	8	8	9	7	7	6	7
6.	Children's Museum	13	9	8	7	7	7	7	6	6	6	6
7.	Reserve Bank	25	14	12	12	12	12	15	11	11	9	10
8.	Stone & Webster	16	14	10	10	11	11	12	9	8	8	9
9.	U.S. Postal Annex	12	9	7	7	7	7	8	6	6	5	6
10.	CO Monitor-Kneeland	18	14	10	9	12	12	11	10	8	11	11
11.	Tai Tung Park	15	12	9	9	10	10	10	8	7	8	8
12.	N.E. Aquarium	14	10	8	8	8	8	9	7	7	6	6
13.	Quincy Market	22	24	11	10	10	10	25	9	8	9	8
14.	Martignettis	20	27	9	9	9	9	28	7	7	7	7
15.	Residence Near Vent	13	11	7	6	6	6	11	5	5	5	5
16.	Playgrd. on Commercial	25	15	14	13	12	12	11	11	12	11	11
17.	West End Apts.	16	11	8	8	8	8	7	6	8	6	7
18.	Tennis Courts	21	14	13	14	14	14	13	13	12	12	13
19.	City Square	17	11	10	10	10	10	10	7	8	7	7
20.	Heritage Apts.	10	6	5	4	5	4	6	5	3	4	3
21.	Maverick Sq.	13	9	6	5	6	5	10	6	4	6	4
22.	Paris St. Health Center	15	12	6	5	6	5	13	5	4	5	4
23.	Residence on Havre	32	22	5	5	6	5	27	5	4	5	4
24.	Daniel Webster School	14	8	5	5	5	5	8	5	4	5	4
25.	Day Square	13	6	6	6	6	6	5	6	6	6	6
26.	Porzio Park	7	6	4	4	4	4	5	3	4	3	3
27.	E. Boston Mem. Stadium	11	8	5	5	5	5	8	5	4	5	5
28.	Hilton Hotel	12	9	8	6	8	6	8	7	5	7	5
29.	North End Near Sumner/Boston Vent	12	8	7	6	6	7	7	5	5	5	5
30.	South Bay Near V0	8	6	6	5	5	5	5	4	4	4	4
31.	Sumner/Cottage Near V2	8	5	5	5	4	4	5	3	3	4	4
32.	Chelsea St., Near Sumner Vent	14	4	5	4	5	4	4	5	3	4	3
33.	Central Sq., E. Boston	23	11	5	5	5	5	11	5	4	5	4
34.	Atlantic Ave. Near V1	18	13	12	12	11	11	13	10	11	9	9
35.	Bell Circle-Legion Hwy.	9	5	5	5	5	5	4	4	4	4	4
36.	Bell Circle-V.F.W. Hwy.	7	5	5	5	5	5	3	4	4	4	4
37.	Bell Circle-Residence on Richborn St.	9	6	6	6	6	6	6	5	5	5	6
38.	Bell Circle-Mooney Rd.	12	8	9	8	8	8	7	7	7	8	7

*Concentrations are given in parts per million (ppm). The 1-hr standard is 35 ppm. All entries include background CO concentrations of 4 ppm in 1982, 2.1 ppm in 1990, and 1.6 ppm in 2010.

to range from 7 parts per million (ppm) to 32 ppm. Areas with high traffic congestion - for example, at Receptor 23 near the Sumner Tunnel portal; Receptor 16 near Keany Square; and Receptor 7 near Dewey Square - were estimated to have 1-hour concentrations that exceed 25 ppm. However, no violation of the 1-hour standard of 35 ppm was predicted at any site.

Estimates of maximum 8-hour CO concentrations in 1982 are shown in Table 40. Under 1982 conditions, violations of the 8-hour standard of 9 ppm were estimated at 10 receptor locations. These areas of excessive CO concentration are the Rotch Playground, Federal Reserve Bank and Stone & Webster (Dewey Square area), Kneeland Street near the Central Artery Ramps, Quincy Market, Martignetti's at the Sumner Tunnel exit portal, the tennis courts near the MDC Police Station on Storrow Drive, Havre Street near the Sumner Tunnel portal in East Boston, Central Square in East Boston, and on the waterfront near Fort Point Channel (Atlantic Avenue). Additionally, receptor locations at Tai Tung Park, the New England Aquarium, the West End Apartments, and City Square in Charlestown were estimated to have 8-hour CO concentrations approximately equal to 9 ppm. These estimates suggest that under 1982 conditions, potential violation of the 8-hour CO standard is widespread in many parts of Boston and East Boston, where traffic congestion is present.

Effects of Toll Plazas

The effects of motor vehicle emissions at toll plazas are measured in terms of their potential for exceeding the 8-hour CO standard and the Environmental Protection Agency's (EPA) proposed 1-hour NO_2 standard. Since the effects of toll plaza emissions are generally experienced only by receptors in the immediate vicinity of the toll plaza area, a special group of receptor locations in East Boston was selected to monitor the effects not only of the existing Sumner and Callahan Tunnel toll plazas, but also of the proposed toll plaza locations along the railroad right-of-way in East Boston (Alternatives 2 and 4) and at Logan Airport (Alternatives 3 and 5). These receptors are listed in Table 41.

The maximum 8-hour CO concentrations from the existing Sumner and Callahan toll plazas in 1982 are shown in Table 41. As anticipated, receptors near the toll plazas - for example, the residences at Havre Street, near the intersection of Bremen and Porter Streets, and just south of the Callahan Tunnel portal - were estimated to have 8-hour CO concentrations that exceeded 4 ppm. At the Havre Street location, toll plaza emissions alone were responsible for approximately 12 ppm, which is greater than the 9 ppm standard.

The effects of toll plaza emissions were also examined in terms of their contributions to maximum 1-hour NO_2 concentrations. Also as shown in Table 41, the receptor locations in the proximity of the Sumner and Callahan toll plazas were estimated to have 1-hour NO_2 concentrations in the range of approximately 300 to 460 micrograms per cubic meter (ug/m^3). These contributions are quite significant when measured against the EPA's proposed 1-hour standard of between 470 and 940 ug/m^3.

Effects of Existing Ventilation Buildings

The effects of existing ventilation buildings are described both in terms of the air quality in the tunnels served by the various exhaust vents, and the effects on air quality due to the venting of the exhaust gases.

Under design conditions (i.e., all ventilation fans in operation and no traffic tie-ups), the average 1-hour CO concentrations in the existing tunnels range from about 51 to 86 mg/m^3. The highest concentration, as shown in Table 42,

Table 40

ESTIMATED MAXIMUM 8-HR CARBON MONOXIDE CONCENTRATIONS* AT SELECTED RECEPTOR LOCATIONS FOR VARIOUS ANALYSIS YEARS.

Receptor Locations	1982	1990					2010				
	Existing	Alternatives					Alternatives				
		1	2	3	4	5	1	2	3	4	5
1. Rotch Playground	11	5	6	5	6	6	4	4	4	4	4
2. Columbus Park	6	3	3	3	3	3	2	2	2	2	2
3. Residence-Dorchester Ave.	6	4	4	4	4	4	3	3	3	3	3
4. Broadway Station	6	3	3	4	3	3	2	2	3	3	2
5. Tea Party Ship	7	4	5	4	4	4	4	4	4	4	3
6. Children's Museum	7	4	4	4	4	4	3	3	3	3	3
7. Reserve Bank	10	7	7	7	5	6	6	6	6	6	4
8. Stone & Webster	10	6	6	6	5	5	5	5	5	5	4
9. U.S. Postal Annex	7	4	4	5	4	4	3	4	4	3	3
10. CO Monitor-Kneeland	12	7	7	6	7	8	7	6	5	6	5
11. Tai Tung Park	9	5	5	5	5	5	5	4	4	4	4
12. N.E. Aquarium	9	5	5	4	4	4	4	3	3	3	3
13. Quincy Market	11	10	5	6	5	5	10	4	5	5	4
14. Martignettis	12	14	5	5	5	5	14	4	4	5	4
15. Residence Near Vent	8	5	4	4	4	3	5	3	3	3	3
16. Playgrd. on Commercial	8	6	4	4	4	4	4	4	4	4	4
17. West End Apts.	9	5	5	5	5	5	6	5	5	5	5
18. Tennis Courts	14	9	8	8	8	8	10	8	8	8	8
19. City Square	9	5	5	5	4	4	4	4	4	4	4
20. Heritage Apts.	6	4	4	3	4	2	4	3	2	3	2
21. Maverick Sq.	7	5	4	3	4	3	5	3	2	3	2
22. Paris St. Health Center	8	7	4	3	4	3	8	3	3	3	3
23. Residence on Havre	16	13	4	4	4	3	15	3	3	3	3
24. Daniel Webster School	6	6	4	3	4	3	7	4	3	4	3
25. Day Square	8	6	6	6	6	6	5	5	5	5	5
26. Porzio Park	5	3	3	3	3	3	3	2	2	2	2
27. E. Boston Mem. Stadium	6	5	3	3	3	3	6	3	3	3	3
28. Hilton Hotel	7	5	4	4	4	4	6	4	3	4	3
29. North End Near Sumner/Boston Vent	8	4	4	4	4	4	3	3	3	3	3
30. South Bay Near V0	6	3	4	4	3	4	2	3	3	3	3
31. Sumner/Cottage Near V2	5	3	3	3	3	3	2	2	2	2	2
32. Chelsea St., Near Sumner Vent	7	3	3	3	3	3	2	3	2	3	2
33. Central Sq., E. Boston	11	8	4	3	4	3	8	4	3	4	3
34. Atlantic Ave. Near V1	10	6	6	5	5	5	5	5	5	4	4
35. Bell Circle-Legion Hwy.	7	3	3	3	3	3	2	2	2	2	2
36. Bell Circle-V.F.W. Hwy.	5	3	3	3	3	3	2	2	2	2	2
37. Bell Circle-Residence on Richborn St.	7	3	3	4	3	3	3	3	3	3	3
38. Bell Circle-Mooney Rd.	8	5	4	5	5	5	4	4	4	4	4

*Concentrations are given in parts per million (ppm). The 8-hr standard is 9 ppm. All entries include background CO concentrations: 3.2 ppm in 1982, 1.7 ppm in 1990, and 1.3 ppm in 2010.

Table 41

CONTRIBUTION OF TOLL PLAZA EMISSIONS ON MAXIMUM 8-HR CARBON MONOXIDE AND 1-HR NITROGEN DIOXIDE CONCENTRATIONS*
FOR VARIOUS ANALYSIS YEARS

Receptor Locations	1982	1990						2010					
	Existing	Alternatives						Alternatives					
		1	2&4			3&5		1	2&4			3&5	
8-Hr CO		Open	Open	Semi-Open	Closed	Open	Semi-Open	Open	Open	Semi-Open	Closed	Open	Semi-Open
EAL Reservation Ctr.	1.0	0.6	<0.2	<0.2	<0.2	0.2	<0.2	0.8	<0.2	<0.2	<0.2	0.3	0.2
Jeffries Point Park	1.0	0.9	<0.2	<0.2	<0.2	0.3	0.2	1.1	<0.2	<0.2	<0.2	0.4	<0.3
BIF Park (proposed)	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2	<0.2	0.2	<0.2
Maverick Sq.	2.3	1.8	0.2	<0.2	<0.2	<0.2	<0.2	2.4	0.2	<0.2	<0.2	<0.2	<0.2
Residence at Orleans/Porter	2.4	1.3	0.3	0.2	<0.2	<0.2	<0.2	1.6	0.2	<0.2	<0.2	<0.2	<0.2
Residence at Bremen/Porter	4.0	2.1	<0.2	<0.2	<0.2	<0.2	<0.2	2.6	<0.2	<0.2	<0.2	<0.2	<0.2
Residence at Bremen/Gove	3.7	3.4	0.4	0.3	<0.2	0.2	<0.2	4.7	0.2	<0.2	<0.2	<0.2	<0.2
Residence near Callahan Tunnel													
Toll Plaza	7.8	5.7	0.3	0.3	0.3	0.2	<0.2	8.0	0.3	<0.2	<0.2	0.3	0.2
Residence on Havre St.	11.7	8.8	<0.2	<0.2	<0.2	<0.2	<0.2	11.5	0.2	<0.2	<0.2	<0.2	<0.2
1-Hour NO2													
EAL Reservation Ctr.	51	35	<10	<10	<10	12	<10	63	<10	<10	<10	18	13
Jeffries Pt. Park	36	47	<10	<10	<10	15	12	57	<10	<10	<10	22	15
BIF Park (proposed)	13	40	<10	<10	<10	10	<10	53	<10	<10	<10	15	11
Maverick Sq.	108	118	12	<10	<10	<10	<10	171	13	<10	<10	<10	<10
Residence at Orleans/Porter	150	109	27	15	<10	<10	<10	152	22	<10	<10	<10	<10
Residence at Bremen/Porter	383	281	21	10	<10	10	<10	375	19	<10	<10	12	<10
Residence at Bremen/Gove	189	242	27	23	10	10	<10	359	22	<10	<10	12	<10
Residence near Callahan Tunnel													
Toll Plaza	293	296	15	12	12	12	10	486	19	<10	<10	13	11
Residence on Havre St.	463	485	<10	<10	<10	10	10	686	10	<10	<10	12	10

*Concentrations are given in parts per million (ppm) for CO and micrograms per cubic meter (ug/m^3) for NO_2.
The 8-hr CO standard is 9 ppm; the proposed 1-hr NO_2 standard is in the range of 470 to 940 ug/^{3}m. See text for conclusions relative to air quality effects of covering toll plaza.

Table 42
ESTIMATED 1-HOUR CARBON MONOXIDE CONCENTRATIONS* IN THE VARIOUS TUNNELS

Tunnel Description	1982	1990					2010				
		1	2	3	4	5	1	2	3	4	5
V0 segments at South Bay	-	-	43	43	22	20	-	38	38	19	19
V1 segments near Fort Point Channel	-	-	44	42	36	32	-	40	40	32	30
V2 segments in East Boston	-	-	45	33	45	31	-	40	30	41	29
Sumner	86	57	21	18	21	18	60	21	17	22	17
Callahan	76	62	21	22	21	22	61	21	18	21	19
Dewey Square Southbound	69	63	32	31	36	36	54	28	28	29	29
Dewey Square Northbound	51	43	23	22	22	22	34	19	19	17	18

*Concentrations are in milligrams per cubic meter (mg/m^3). The ASHRAE guideline for one-hour concentration is 143 mg/m^3.

Table 43
ESTIMATED 1-HOUR NITROGEN DIOXIDE CONCENTRATIONS* IN THE VARIOUS TUNNELS

Tunnel Description	1982	1990					2010				
		1	2	3	4	5	1	2	3	4	5
V0 segments at South Bay	-	-	3.1	3.1	2.2	2.0	-	2.8	2.8	2.1	2.0
V1 segments near Fort Point Channel	-	-	3.2	3.0	3.6	3.2	-	2.9	2.9	3.4	3.2
V2 segments in East Boston	-	-	3.4	2.8	3.4	2.6	-	3.1	2.8	3.2	2.6
Sumner	4.2	2.4	1.6	1.5	1.6	1.5	2.2	1.6	1.6	1.7	1.5
Callahan	3.7	2.7	1.6	1.9	1.6	1.9	2.3	1.6	1.7	1.6	1.8
Dewey Square Southbound	4.3	3.5	2.3	2.2	3.5	3.5	3.0	2.0	2.0	3.1	3.1
Dewey Square Northbound	3.2	2.4	1.6	1.6	2.1	2.2	1.9	1.4	1.4	1.9	1.9

*Concentrations are in milligrams per cubic meter (mg/m^3). There are no applicable standards for NO_2 within the tunnels at this time.

was estimated for the Sumner Tunnel at 86 mg/m3. Because of the transitory exposure by the public in using the tunnel, this 1-hour average concentration is acceptable. However, if the tunnels operate under less than intended design conditions (for example, fans malfunctioning or presence of traffic congestion), the concentrations inside the tunnels could reach excessive levels.

Table 43 shows the estimated 1-hour NO_2 concentrations under the same design conditions. These concentrations range from over 3200 ug/m3 in the Dewey Square northbound tunnel to over 4100 ug/m3 in the Sumner Tunnel. Again, these levels are assumed to be acceptable because of the limited exposure time incurred by the public in traveling through the tunnel. If less than ideal design conditions should occur, excessive NO_2 levels could result in these tunnels.

Effects from ventilation buildings on the surrounding CO concentrations were found to be quite insignificant. Consequently, the analysis concentrates on the effects on 1-hour NO_2 concentration. The effects from all existing ventilation buildings on the various receptor locations, using EPA's ISC computer model, are shown in Table 44. The contributions from the vents collectively range from about 15 to 50 ug/m3. These concentrations are insignificant when measured against the proposed 1-hour standard.

The effects from ventilation buildings, however, are mostly felt in a "near-field" environment - when the receptor location is within 100 meters of the exhaust vent. To examine this effect, an algorithm based on Halitsky's method (see Appendix 5) was used, and the results are given in Table 45.

In Table 45, the effects from each ventilation building are presented at various distances from the exhaust vent. Because of differences in dispersion characteristics, the results are separated into two groups: 1) roof top, which pertain to air intake locations of adjacent buildings; and 2) pedestrian/sidewalk locations. Results for the following existing vents were accounted for individually:

- S1, Sumner Tunnel vent at North Street, Boston;
- S2, Sumner Tunnel vent at Liverpool Street, East Boston;
- C1, Callahan Tunnel vent at North Street, Boston;
- C2, Callahan Tunnel vent at Decatur and London Streets, East Boston;
- DSSB1, Dewey Square southbound tunnel vent at Beach Street, Boston;
- DSSB2, Dewey Square southbound tunnel vent at Summer Street, Boston;
- DSNB1, Dewey Square northbound tunnel vent at Essex Street, Boston; and
- DSNB2, Dewey Square northbound tunnel vent at Atlantic Avenue, Boston.

Effects on adjacent rooftop air intakes under 1982 conditions are generally not significant unless the air intakes are located within 10 meters of the exhaust vent openings, and the background NO_2 level exceeds 100 ug/m3. Even under these conditions, the highest expected 1-hour NO_2 concentration (from the Dewey Square southbound tunnel vent at Beach Street) was estimated at about 340 ug/m3, which is below the range of the EPA's proposed 1-hour standard. Effects on pedestrian level receptor locations were estimated to be insignificant; the maximum contribution to the 1-hour NO_2 concentration was estimated at about 100 ug/m3 for a receptor near the Beach Street vent. This level is well below the proposed standard.

Table 44

CONTRIBUTIONS OF VENTILATION BUILDING EMISSIONS ON 1-HR NITROGEN DIOXIDE CONCENTRATIONS*

Receptor Locations	1982	1990					2010				
		1	2	3	4	5	1	2	3	4	5
1. Rotch Playground	33	23	33	15	20	20	20	14	14	18	18
2. Columbus Park	15	10	15	9	9	9	9	7	8	9	9
3. Residence-Dorchester Ave.	23	16	23	12	14	14	14	10	11	12	13
4. Broadway Station	28	20	38	24	17	18	17	21	21	15	16
5. Tea Party Ship	28	22	28	21	21	21	18	16	20	18	20
6. Children's Museum	29	21	29	20	21	21	19	16	20	18	20
7. Reserve Bank	28	19	24	21	20	21	16	16	20	18	21
8. Stone & Webster	25	18	23	21	19	21	19	16	20	18	21
9. U.S. Postal Annex	24	19	24	19	18	19	16	15	18	17	19
10. CO Monitor-Kneeland	45	31	45	21	26	27	26	19	19	24	24
11. Tai Tung Park	45	32	45	21	28	29	28	19	19	25	26
12. N.E. Aquarium	29	22	29	22	21	22	19	17	21	19	21
13. Quincy Market	36	22	36	14	13	14	19	13	14	14	14
14. Martignettis	35	18	35	12	12	12	17	12	12	12	12
15. Residence Near Vent	40	11	55	20	21	21	9	20	21	21	22
16. Playgrd. on Commercial	23	13	23	10	11	12	11	8	9	10	10
17. West End Apts.	15	11	15	7	10	10	9	6	6	9	9
18. Tennis Courts	13	8	13	6	8	8	7	5	6	7	7
19. City Square	16	9	16	8	8	8	8	6	7	8	8
20. Heritage Apts.	24	15	30	39	29	36	13	27	38	27	36
21. Maverick Sq.	26	14	26	23	23	24	12	18	22	21	24
22. Paris St. Health Center	31	17	30	16	17	17	15	13	16	16	17
23. Residence on Havre	50	31	50	21	21	22	27	19	19	20	21
24. Daniel Webster School	19	11	19	16	18	18	10	13	15	16	17
25. Day Square	25	16	25	11	12	12	14	10	10	11	11
26. Porzio Park	12	8	12	7	8	8	7	6	7	8	8
27. E. Boston Mem. Stadium	20	13	20	14	15	15	11	11	13	14	15
28. Hilton Hotel	13	8	13	9	10	10	7	8	9	9	10
29. North End Near Sumner/Boston Vent	37	18	42	24	23	24	15	20	22	22	23
30. South Bay Near V0	30	21	30	29	19	21	18	20	26	17	21
31. Sumner/Cottage Near V2	20	12	20	14	15	16	11	12	14	14	16
32. Chelsea St., Near Sumner Tunnel Vent	31	14	28	18	18	19	12	14	17	17	19
33. Central Sq., E. Boston	38	23	38	22	23	23	20	19	21	22	22
34. Atlantic Ave. Near V1	24	19	24	33	18	43	16	11	32	16	44

*Concentrations are in micrograms per cubic meter (ug/m3), and do not include background concentrations.

Table 45

CONTRIBUTIONS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM 1-HOUR NITROGEN DIOXIDE CONCENTRATIONS* IN THE IMMEDIATE VICINITY OF THE VENTS

Vent ID	Analysis Year and Alternative		Roof Top/Air Intake Receptor Distances (m) 10	20	30	50	100	Pedestrian/Sidewalk Location Receptor Distances (m) 10	20	30	50	100
V0	1990	2	328	304	283	246	180	164	152	141	123	90
		3	330	304	283	246	180	165	153	142	123	90
		4	247	228	212	183	133	124	114	106	92	66
		5	227	209	194	168	122	113	105	97	84	61
	2010	2	297	275	255	222	162	148	137	128	111	81
		3	297	275	255	222	162	148	137	128	111	81
		4	237	219	203	176	127	118	109	101	94	88
		5	230	212	197	170	124	115	106	98	85	62
V1	1990	2	351	330	310	276	212	175	165	155	138	106
		3	326	309	293	265	210	163	154	146	132	105
		4	381	356	334	295	224	191	178	167	148	112
		5	342	323	306	275	216	171	162	153	138	108
	2010	2	322	303	285	254	195	161	151	142	127	97
		3	314	298	282	255	202	157	149	141	127	101
		4	361	337	316	280	212	180	169	158	140	106
		5	345	326	309	278	218	173	163	154	139	109
V2	1990	2	316	296	279	248	189	158	148	139	124	95
		3	233	222	211	191	153	117	111	105	96	76
		4	324	304	285	254	194	162	152	143	127	97
		5	267	254	241	219	175	134	127	121	109	87
	2010	2	288	270	254	225	173	144	135	127	113	86
		3	232	220	209	190	152	116	110	105	95	76
		4	303	285	268	238	182	152	142	134	119	91
		5	266	253	240	218	174	133	126	120	109	87
S1	1982		214	201	190	169	131	107	101	95	85	65
	1990	1	124	116	110	98	76	62	58	55	49	38
		2	80	76	71	64	49	40	38	36	32	25
		3	76	72	68	61	47	38	36	34	30	23
		4	80	76	71	64	49	40	38	36	32	25
		5	77	72	68	61	47	38	36	34	30	23
	2010	1	114	107	101	90	70	57	54	51	45	35
		2	82	77	73	65	50	41	39	37	33	25
		3	80	76	71	64	49	40	38	36	32	25
		4	85	80	76	68	52	43	40	38	34	26
		5	79	74	70	62	48	39	37	35	31	24
S2	1982		137	129	122	109	84	69	65	61	54	42
	1990	1	79	75	70	63	49	40	37	35	31	24
		2	52	49	46	41	32	26	24	23	20	16
		3	49	46	44	39	30	25	23	21	20	15
		4	52	49	46	41	32	26	24	23	20	16
		5	49	46	44	39	30	25	23	22	20	15
	2010	1	73	69	65	58	45	37	34	32	29	22
		2	53	50	47	42	32	26	25	23	21	16
		3	52	49	46	41	32	26	24	23	20	16
		4	55	52	49	43	34	27	26	24	22	17
		5	51	48	45	40	31	25	24	22	20	15

Table 45 (cont'd.)

CONTRIBUTIONS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM 1-HOUR NITROGEN DIOXIDE CONCENTRATIONS* IN THE IMMEDIATE VICINITY OF THE VENTS

Vent ID	Analysis Year and Alternative		Roof Top/Air Intake Receptor Distances (m) 10	20	30	50	100	Pedestrian/Sidewalk Location Receptor Distances (m) 10	20	30	50	100
C1	1982		161	152	143	128	99	81	76	72	64	49
	1990	1	115	108	102	91	70	57	54	51	46	35
		2	69	65	61	54	42	34	32	30	27	21
		3	80	75	71	63	49	40	38	35	32	24
		4	69	65	61	54	42	34	32	30	27	21
		5	80	75	71	63	49	40	38	35	32	24
	2010	1	99	93	88	79	61	50	47	44	39	30
		2	68	64	61	54	42	34	43	30	27	21
		3	73	69	65	58	45	37	34	32	29	22
		4	68	64	61	54	42	34	32	30	27	21
		5	76	72	68	61	47	38	36	34	30	23
C2	1982		186	175	165	148	114	93	88	83	74	57
	1990	1	133	125	118	105	81	66	63	59	53	41
		2	79	75	70	63	49	40	37	35	31	24
		3	92	87	82	73	56	46	44	41	37	28
		4	79	75	70	63	49	40	37	35	31	24
		5	92	87	82	73	56	46	44	41	37	28
	2010	1	115	108	102	91	70	57	54	51	45	35
		2	79	74	70	62	48	40	37	35	31	24
		3	84	79	75	67	52	42	40	37	33	26
		4	79	74	70	62	48	40	37	35	31	24
		5	88	83	78	70	54	44	42	39	35	27
DSSB1	1982		238	220	204	177	129	119	110	102	88	64
	1990	1	191	177	164	142	103	95	88	82	71	52
		2	125	116	108	93	68	63	58	54	47	34
		3	123	114	106	92	67	62	57	53	46	33
		4	195	180	167	145	105	97	90	84	72	53
		5	195	180	167	145	105	97	90	84	72	53
	2010	1	165	153	142	123	89	83	76	71	61	45
		2	112	103	96	83	61	56	52	48	42	30
		3	112	103	96	83	61	56	52	48	42	30
		4	168	155	144	125	91	84	78	72	62	45
		5	169	156	145	126	92	84	78	72	63	46
DSSB2	1982		196	181	168	146	106	98	91	84	73	53
	1990	1	157	146	135	117	85	79	73	68	59	43
		2	103	96	89	77	56	52	48	44	39	28
		3	102	94	87	76	55	51	47	44	38	28
		4	161	149	138	119	87	80	74	69	60	44
		5	161	149	138	119	87	80	74	69	60	44
	2010	1	136	126	117	101	74	68	63	58	51	37
		2	92	85	79	69	50	46	43	40	34	25
		3	92	85	79	69	50	46	43	40	34	25
		4	138	128	119	103	75	69	64	59	52	38
		5	139	129	119	104	75	70	64	60	52	38

Table 45 (cont'd.)

CONTRIBUTIONS OF VENTILATION BUILDING EMISSIONS ON MAXIMUM 1-HOUR NITROGEN DIOXIDE CONCENTRATIONS* IN THE IMMEDIATE VICINITY OF THE VENTS

Vent ID	Analysis Year and Alternative		Roof Top/Air Intake Receptor Distances (m)					Pedestrian/Sidewalk Location Receptor Distances (m)				
			10	20	30	50	100	10	20	30	50	100
DSNB1	1982		185	171	159	138	100	93	86	80	69	50
	1990	1	137	127	118	102	74	69	63	59	51	37
		2	94	87	80	70	51	47	43	40	35	25
		3	93	86	79	69	50	46	43	40	34	25
		4	112	113	105	91	66	61	56	52	45	33
		5	125	115	107	93	68	62	58	54	46	34
	2010	1	112	103	96	83	60	56	52	48	42	30
		2	80	74	68	59	43	40	37	34	30	22
		3	80	74	68	59	43	40	37	34	30	22
		4	107	99	92	80	56	54	49	46	40	59
		5	109	101	94	81	59	55	51	47	41	30
DSNB2	1982		219	203	188	163	119	110	101	94	82	59
	1990	1	162	150	139	121	88	81	75	70	60	44
		2	111	103	95	83	60	55	51	48	41	30
		3	110	101	94	82	59	55	51	47	41	30
		4	144	134	124	107	78	72	67	62	54	39
		5	148	137	127	110	80	74	68	63	55	40
	2010	1	132	122	113	98	72	66	61	57	49	36
		2	95	87	81	70	51	47	44	41	35	26
		3	95	87	81	70	51	47	44	41	35	26
		4	127	117	109	94	69	63	59	54	47	34
		5	129	120	111	96	70	65	60	56	48	35

Long-Term Impacts

Emissions

With the No-Build Alternative, emissions of CO, NO_x, and NMHC were estimated to decrease with time. This decrease is especially pronounced between 1982 and 1990. For example, during this period, CO emissions were projected to decrease by 33 percent, NO_x by 28 percent, and NMHC by 56 percent. This improvement is attributed to the anticipated decreases in motor vehicle emissions as a result of the Federal Motor Vehicle Control Program (FMVCP). Total emissions continue to decrease with time; by 2010, CO emissions were estimated at 61 percent of the corresponding emissions in 1982. Similarly, the 2010 NO_x and NMHC emissions were estimated at about 66 percent and 37 percent of their corresponding 1982 emissions.

CO Levels

Maximum 1-hour CO concentrations at selected receptor locations in the project area were estimated to range from about 4 to 27 ppm in 1990, and from about 3 to 28 ppm in 2010 with the No-Build Alternative. No violation of the 1-hour standard of 35 ppm is anticipated anywhere. As shown in Table 39, CO concentrations generally decrease with time except near the Callahan Tunnel entrance in the North End, and the Sumner and Callahan Tunnels toll plaza in East Boston, where maximum 1-hour CO concentrations were estimated to increase through 2010 due to increased congestion at the toll plaza.

As in 1982 baseline conditions, excessive 8-hour CO concentrations were estimated in 1990 and 2010 under the No-Build Alternative. Violations of the 9-ppm standard were predicted for receptors near the Callahan Tunnel entrance (for example, at Receptor No. 13 at Quincy Market, and at Receptor No. 14 at Martignetti's), at the tennis courts on Storrow Drive, and near the Sumner Tunnel portal in East Boston (Receptor No. 23). As in the 1-hour case, 8-hour concentrations for receptors located near the existing tunnel portals are expected to increase with time because the significant increases in queuing delay and the resulting increases in emissions will more than offset the benefits from the FMVCP.

Toll Plazas

With the No-Build Alternative, average queue time for a vehicle during the peak hour at the Sumner toll plaza was estimated to increase from about 5.8 minutes in 1982 to 10.8 minutes in 1990, and 12.5 minutes in 2010. Similar increases were also estimated for the Callahan toll plaza, from 0.6 minutes in 1982 to 8.7 minutes in 1990, and 14.5 minutes in 2010. The effects of these increases are to offset the improvements that are expected under the FMVCP. The net effects are shown in Table 41. Eight-hour CO concentrations at all receptors were shown to decrease from their corresponding 1982 estimates. No violation of the 9-ppm standard was estimated, although 8-hour CO from the toll plazas alone was a very significant factor in the excessive levels found at the Havre Street receptor location. By 2010, significantly high 8-hour concentration was estimated for a receptor near the Callahan toll plaza, and violation of the standard was estimated for the Havre Street receptor location. Table 41 also shows the effects of the toll plaza emissions on maximum 1-hour NO_2 concentrations. When measured against the EPA proposed NO_2 standard, and assumed background of 100 ug/m^3, NO_2 concentrations for 1990 were estimated for residences at the intersections of Bremen and Porter Streets and Bremen and Gore Streets; near the Callahan Tunnel toll plaza; and on Havre Street. These same four locations continue to show increases in their 1-hour NO_2 concentrations

through 2010.

Ventilation Buildings

Under design conditions, no significant 1-hour CO or NO_2 concentrations were estimated inside the various tunnels under the No-Build Alternative. As shown in Table 42, 1-hour CO concentrations were estimated to range from about 43 to 63 mg/m3 in 1990, and from 34 to 61 mg/m3 in 2010. For NO_2, the concentrations in the tunnels were estimated to range from about 2400 to 3500 ug/m3 in 1990, and from 1990 to 3000 ug/m3 in 2010. Because of the transitory exposure in using these tunnels, these 1-hour CO and NO_2 concentrations are acceptable.

As in the 1982 case, effects of the ventilation buildings on the surrounding CO concentrations were estimated to be insignificant. The effects on 1-hour NO_2 concentrations for receptors located more than 100 meters away from the vents are also insignificant. Under the No-Build Alternative, the highest 1-hour NO_2 concentration at pedestrian sidewalk level was estimated at about 85 ug/m^3 for the Dewey Square southbound tunnel vent at Beach Street. This concentration is not significant when measured against the EPA's proposed NO_2 standard. For rooftop air intakes on adjacent buildings, the highest 1-hour NO_2 concentrations were estimated to come from the Dewey Square northbound tunnel vent located at Atlantic Avenue. The 1990 1-hour NO_2 concentrations for air intakes that are located within 30 to 50 meters of the vent were estimated at between 120 and 140 ug/m3. These concentrations are also not excessive. As shown in Table 45, the 1-hour NO_2 concentrations were projected to decrease with time.

4.6.2 Alternative 2

Long-Term Impacts

Emissions

The 1990 24-hour emissions of CO, NO_x, and NMHC under Alternative 2 were estimated to be significantly less than the corresponding 1982 emissions. When compared with the 1990 No-Build Alternative estimates, emissions from Alternative 2 are lower by 3 percent for CO, 0.5 percent for NO_x, and 4 percent for NMHC. These differences, however, are not significant. While CO and NMHC emissions from Alternative 2 continue to be lower than their corresponding No-Build Alternative emissions in 2010, NO_x emissions from Alternative 2 were estimated to be 0.2 percent higher than the corresponding No-Build emissions (again, an insignificant difference).

CO Levels

The maximum 1-hour CO concentration estimated under Alternative 2 in 1990 is approximately 14 ppm, for a receptor located at the playground on Commercial Street at the North End. No violation of the 1-hour standard was estimated anywhere. Compared with the No-Build Alternative, 1-hour CO concentrations under Alternative 2 are expected to be generally lower. Dramatic improvements were estimated for receptors near the existing tunnel portals. For example, the 1990 1-hour CO concentration at the Quincy Market location was estimated to decrease from 24 ppm under the No-Build Alternative to about 11 ppm under Alternative 2. Compared with the No-Build Alternative, peak hour traffic demand for the Callahan Tunnel under Alternative 2 was estimated to decrease by about 48 percent, and the delay time was estimated to decrease from about 5 minutes to essentially free-flow condition. These combined improvements in traffic condition are expected to result in the dramatic decrease in CO concentrations. Table 39 also shows the maximum 1-hour CO concentration for receptor locations at Bell Circle. Compared with the No-Build Alternative, CO concentrations under this alternative were estimated to increase by less

than 1 ppm. This increase is insignificant, however, since the resulting maximum concentrations (5-8 ppm) are well below the 35-ppm standard.

The 1990 8-hour CO concentrations under Alternative 2 were estimated to range from about 3 ppm to 8 ppm at the tennis courts on Storrow Drive. No violation of the 8-hour standard (9 ppm) was found anywhere. The 8-hour CO concentrations were estimated to decrease through 2010.

Toll Plazas

The effects of the new cross harbor tunnel on the average queue time for a vehicle during the peak hour at both the Sumner Tunnel and the Callahan Tunnel are very dramatic. For example, in 1990, the average delay at the Sumner Tunnel toll plaza was projected to decrease from about 10.8 minutes with the No-Build Alternative to about 0.3 minutes under Alternative 2. Similarly, the average delay of 8.7 minutes at the Callahan Tunnel toll plaza under No-Build conditions was estimated to average about 0.4 minutes under Alternative 2. The delay anticipated for the new toll plaza in East Boston was estimated at about 1.1 minutes outbound and 0.4 minutes inbound. Because of this significant decrease in delay and the greater dispersion of the emission sources (i.e., the sources of emissions from the toll plazas under Alternative 2 are distributed over a greater geographical area), 8-hour CO and 1-hour NO_2 concentrations at the selected receptor locations in East Boston were estimated to be very low. As shown in Table 41, maximum 8-hour CO concentrations estimated for a residence near Bremen and Gove Streets was 0.4 ppm. The 1-hour NO_2 concentration for this receptor location was estimated at less than 30 ug/m^3. These concentrations are quite insignificant when compared with their corresponding standards. Eight-hour CO and 1-hour NO_2 concentrations under a semi-open (partially covered) toll plaza configuration were estimated to be only slightly less than their open-configuration counterparts; the differences, however, are quite insignificant. If the proposed toll plaza is completely closed, the effects on 8-hour and 1-hour NO_2 would be only from the Sumner and Callahan Tunnel toll plazas. Under the closed configuration, emissions from the covered toll plaza would be vented from the new ventilation stacks. For those receptors that are in the proximity of the new toll plaza, covering the toll plaza would result in a slight decrease in 8-hour CO and 1-hour NO_2 concentrations.

Tunnel Ventilation

As shown in Tables 42 and 43, no significant 1-hour CO or NO_2 concentrations were estimated within any of the existing or proposed tunnel segments under Alternative 2. In 1990, the 1-hour CO concentration for the new tunnel was estimated to range from about 43 to 45 mg/m^3. Under Alternative 2, the air quality in the existing tunnels was shown to improve significantly over the No-Build Alternative counterparts. For example, in 1990, the 1-hour CO concentrations in the Callahan Tunnel were estimated to decrease from about 62 mg/m^3 under the No-Build Alternative to 21 mg/m^3 under Alternative 2. Similar dramatic improvements are evident with the 1-hour NO_2 estimates shown in Table 43. No excessive concentrations were found in any of the tunnel segments as long as these tunnels were operated under design conditions.

The effects of ventilation building emissions on the surrounding 1-hour NO_2 concentrations are insignificant for receptors that are located more than 100 meters from any vent. For receptor locations that are less than 100 meters away, Table 45 shows that for the Sumner, the Callahan, and the Dewey Square tunnel vents, maximum 1-hour NO_2 concentrations from these vents are estimated to be lower with Alternative

2 than with the No-Build Alternative. This is a direct result of the diversion of traffic from the existing facilities to the new tunnel. Effects from the proposed vents at South Bay (vent V0), Fort Point Channel near Northern Avenue (vent V1), and Pier 1 in East Boston (vent V2) on pedestrians at sidewalk level are all estimated to be insignificant. In the South Bay area, there are no building air intakes within 250 feet; the effects from this vent are not significant.

In the Fort Point Channel area, the maximum 1-hour NO_2 concentrations at the Harbor Plaza Building and the U.S. Customs Building may reach 250 ug/m3. This level is below the EPA's proposed 1-hour standard for NO_2. In the Pier 1 East Boston location, there are no building air intakes that are less than 250 feet from this vent. Therefore, no excessive 1-hour NO_2 concentrations are anticipated from this vent.

Construction Impacts

Construction-related activities can result in temporary adverse effects on existing air quality. The sources of emissions associated with construction activities include direct exhaust emissions from construction equipment, motor vehicle emissions from traffic disruption, and dust. Compared with the emissions from motor vehicle sources in the project area, direct emissions from construction equipment will be insignificant. Therefore, the discussion of construction effects will concentrate only on the effects of traffic disruption and dust.

During the construction period, adverse traffic effects due to detouring traffic are anticipated for a number of locations including Dewey Square, Atlantic Avenue and Congress Street, and Atlantic Avenue and Northern Avenue. Dewey Square and the Atlantic Avenue area were found to be in violation of the 8-hour CO standard in 1982, and if there is significant traffic congestion at these areas during construction, then it is possible that compliance with the 8-hour standard will continue to be a problem during this period. There are a number of other areas, such as Dorchester Avenue and West Broadway, and Northern Avenue and Sleeper Street, where no 8-hour violations were found but where adverse traffic effects are anticipated during the construction period. If the traffic congestion is severe during construction, the potential to exceed the 9-ppm standard at these locations will increase.

Construction of the tunnel along the railroad alignment in East Boston is expected to have small effects in overall traffic flows in the area other than traffic diversions from Sumner Street onto Maverick and Marginal Streets. There are a number of locations in East Boston, such as Havre Street, Central Square, Maverick Square, and Paris Street, that were estimated to have excessive 8-hour CO concentrations through 1990 under a No-Build scenario. The high CO levels are the result of motor vehicle emissions from the existing toll plazas. Because compliance with the standard is already a problem at these locations, any adverse traffic effects -- for example, at Porter and Orleans Streets, and at Central Square -- would exacerbate the anticipated violations.

Construction activities in the railroad right-of-way area in East Boston increase the potential for adverse effects (as manifested in nuisance dust and possible violation of the 24-hour total suspended particulate standard) on the residences along the length of the railroad right-of-way. A similar potential problem exists during the construction period for areas in the South Bay and possibly in the railroad yards in the northern industrial portion of South Boston.

Mitigating Measures

No excessively high 1-hour or

8-hour CO concentrations were estimated at any of the receptor locations analyzed under this alternative. NMHC emissions were estimated to be lower than the corresponding No-Build emissions, and the effects from both the existing and the future toll plazas on both 8-hour CO and 1-hour NO_2 were estimated to be quite insignificant. Therefore, no mitigating measures are necessary for these aspects of the operation under Alternative 2.

Air quality in the existing and the new tunnels is acceptable so long as the tunnels operate under design conditions -- that is, no significant traffic tie-ups and all ventilation fans in operation during peak hours. However, if traffic congestion should occur (for example, vehicles idling or moving at low speeds) and/or there is malfunctioning in the ventilation fans, then excessively high CO and NO_2 could result. To avoid this potential health hazard, the mechanical ventilation system of the proposed tunnels should be maintained in good working order at all times and a procedure for deploying the necessary number of fans into operation (as a function of the CO concentrations in the tunnel, CO in the make-up air, and traffic conditions) should be developed. To facilitate the implementation of the fan schedule, a real-time CO monitoring system in the proposed tunnels should also be installed.

Effects of emissions from the ventilation buildings were found to be acceptable in the South Bay area and the railroad right-of-way in East Boston. In the Fort Point Channel area, however, 1-hour NO_2 concentrations in excess of 320 ug/m^3 could arise at air intake locations in offices that are very close to the proposed ventilation building. To mitigate this potential situation, the exhaust opening could be located at least 100 meters from the nearest air intake, the exhaust gases could be vented from more than one ventilation building in that general location, or the amount of exhaust gases could be re-apportioned.

The potential for excessively high 8-hour CO concentrations during the construction period is noted in the discussion on construction impacts. This potential problem could be alleviated by traffic control measures that would lead to minimizing the increased congestion at street intersections and other local roads, or at areas that were estimated to have potentially high CO levels even before construction.

Dust and accompanying high suspended particulates concentrations is a very common and serious problem associated with construction activities. The mitigating measures for this type of problem are all related to good "housekeeping" practices which need to be enforced. Therefore, the normal construction practice of wetting the exposed earth areas and of covering dust-producing materials during transport should be implemented to minimize dust emissions.

4.6.3 Alternative 3

Long-Term Impacts

Emissions

CO, NO_x, and NMHC emissions under Alternative 3 were estimated to be lower than their corresponding emissions under the No-Build Alternative in both 1990 and 2010. For example, the 1990 CO emissions under Alternative 3 were estimated at 34,800 Kg/day, which is 5 percent less than the No-Build Alternative emissions. Similarly, the NO_x and NMHC emissions are respectively 2 percent and 6 percent less than the corresponding No-Build Alternative emissions in 1990.

CO Levels

As shown in Table 39, no excessively high 1-hour CO concentrations were estimated for any receptor locations under Alternative 3. Compared with the No-Build Alternative, the CO concentrations

under Alternative 3 are generally lower. As in Alternative 2, significant reductions in CO concentrations were estimated under Alternative 3 for those receptors that are located near the Sumner and Callahan Tunnel portals. The differences in the proposed alignments of the new tunnel are reflected in the differences in 1-hour CO concentrations for receptors located at Maverick Square and at Porzio Park in Jeffries Point. These differences are small (less than 2 ppm), and are considered not significant since the total concentrations are significantly lower than the 35-ppm standard.

The 8-hour CO concentrations under Alternative 3 are generally not very different from the corresponding concentrations under Alternative 2. This is especially true for receptors that are located along the Fort Point Channel area -- for example, at the New England Aquarium, and at Atlantic Avenue near the Northern Avenue Bridge. No violation of the 8-hour standard is found anywhere. The highest 8-hour concentration was estimated at 8 ppm for a receptor located at the tennis courts on Storrow Drive.

Toll Plazas

The dramatic decrease in average queue time at both the Sumner and Callahan Tunnels is projected for Alternative 3 as well as for all new tunnel alternatives. Because of this significant decrease in delay, the estimated 8-hour CO and 1-hour NO_2 concentrations at all receptor locations were very low. Compared with Alternative 2, receptors that are closer to Jeffries Cove -- for example the Eastern Airlines Reservation Center, Porzio Park, and the proposed Bird Island Flats Park -- were estimated to have slightly higher 8-hour CO and 1-hour NO_2 concentrations, although the differences are quite insignificant. As shown in Table 41, partially covering the toll plaza would result in a small, insignificant decrease in both CO and NO_2 concentrations for those receptors that are very close to the toll plaza.

Tunnel Ventilation

As in Alternative 2, when the new tunnel is operable under Alternative 3, significant improvement in the air quality inside the Sumner, Callahan, and Dewey Square tunnels is anticipated. For example, 1-hour CO concentrations in the Sumner Tunnel were estimated to decrease from about 57 mg/m^3 under the No-Build Alternative to about 18 mg/m^3 under Alternative 3. Similar improvements were estimated for 1-hour NO_2 concentrations. Compared with Alternative 2, the CO and NO_2 concentrations in the tunnel under this alternative are similar in the South Bay and Fort Point Channel areas. But for the East Boston segments, the concentrations were estimated to be lower with Alternative 3. Again, as long as these tunnels operate under design conditions, no excessive CO or NO_2 levels are anticipated.

For receptors that are located more than 100 meters from any vent, the maximum 1-hour NO_2 concentrations were estimated to be quite insignificant. As shown in Table 44, the highest 1-hour NO_2 concentration was estimated at about 40 ug/m^3 for a receptor located at the Heritage Apartments in East Boston. No excessively high NO_2 concentrations were estimated for any receptors located at sidewalk level near any of the vent buildings. Similarly, no excessively high NO_2 concentrations are anticipated for air intakes in nearby buildings in the vicinity of the vents at South Bay, and at Jeffries Cove. However, in the Fort Point Channel area, air intakes on buildings near vent V1 (near Northern Avenue) may be exposed to 1-hour NO_2 concentrations that could exceed 320 ug/m^3.

Construction Impacts

As in Alternative 2, compliance with the 8-hour CO standard may be a

problem during the construction period for areas in Dewey Square and along Atlantic Avenue due to traffic diversions. The potential for excessive 8-hour CO concentrations will also exist for parts of South Boston such as Dorchester Avenue and West Broadway, and the Northern Avenue and Sleeper Street.

Tunnel construction at Jeffries Cove is not expected to have significant effects on traffic flow in East Boston. However, within Logan Airport, the road linking the main airport access and egress roads will be closed. Without proper mitigating measures, the disruption of this signalized intersection could potentially result in excessive 8-hour CO concentrations at receptors located at the Hilton Hotel, the East Boston Memorial Stadium, and Porzio Park.

Under Alternative 3, candidate construction staging areas include the present Butler Aviation site and the unbuilt portions on Bird Island Flats. Potential adverse effects due to fugitive dust emissions can arise for the residences on the north side of the Jeffries Point community and for the concessions within the airport itself.

Mitigating Measures

As in Alternative 2, no excessively high 1-hour or 8-hour CO concentrations were found anywhere; NMHC emissions were lower than the corresponding No-Build emissions; and the effects of the toll plazas on air quality were found to be insignificant. Therefore, no mitigating measures are warranted.

Under non-design conditions, CO and NO_2 in the various tunnel segments can reach very high levels. Therefore, the mitigating measures that should be considered for the proposed ventilation facilities are proper maintenance of the mechanical ventilation system at all times, a schedule for deploying the necessary number of fans, and a real-time CO monitoring system, as discussed previously for Alternative 2.

Measures to mitigate potentially high 1-hour NO_2 concentrations for air intakes located at office buildings in the vicinity of the proposed ventilation buildings at Fort Point Channel are similar to those described for Alternative 2. Measures to reduce potential CO violations at congested areas during construction and control of dust and related particulates are as described for Alternative 2.

4.6.4 Alternative 4

Long-Term Impacts

Emissions

While CO emissions under Alternative 4 were estimated to be lower than in the No-Build Alternative, the NO_x and NMHC emissions in 1990 were estimated to be higher than the corresponding No-Build emissions. The 1990 NMHC emissions of 1710 Kg/day were estimated to be about 2 percent higher than the corresponding No-Build Alternative emissions. However, by 2010, NMHC emissions from Alternative 4 were estimated to be lower than the corresponding emissions under the No-Build Alternative.

CO Levels

Maximum 1-hour CO concentrations under Alternative 4 were estimated to range from about 4 to 14 ppm in 1990, and from 3 to 12 ppm in 2010. No violation of the 1-hour standard was found anywhere. As anticipated, the 1-hour CO concentrations under this alternative are very similar to the corresponding concentrations under Alternative 2 for receptors that are located at the Heritage Apartments, Maverick Square, the Paris Street Health Center, and at Havre Street.

Table 40 shows the maximum 8-hour CO concentrations for the various selected receptors under Alternative 3 for both 1990 and 2010.

These concentrations are generally in the range of 3 to 6 ppm. The only exceptions are found at Kneeland Street (Receptor No. 10) and along Storrow Drive (Receptor No. 18), where the maximum 8-hour concentrations were estimated at 7 and 8 ppm, respectively. These concentrations are still below the 9-ppm standard.

Toll Plazas

Similar to Alternative 2, the diversion of traffic to a new tunnel is expected to result in significant reduction in the average queue time at both the Sumner and Callahan Tunnel toll plazas. From an emissions standpoint, this decrease in delay will more than offset the new queues at the new toll plaza at the railroad right-of-way. Consequently, the estimated 8-hour CO and 1-hour NO_2 concentrations for the selected receptor locations in East Boston are quite insignificant when measured against the applicable standards. The modeling analysis also shows slight decreases in concentrations when employing a closed toll plaza configuration instead of an open configuration.

Tunnel Ventilation

The air quality in the tunnels under Alternative 4 are akin to the corresponding air pollutant concentrations under Alternative 2 for the Sumner, Callahan and proposed new tunnel segments in East Boston. However, for the tunnel segments at South Bay, and at the Fort Point Channel area, the 1-hour CO and NO_2 levels were estimated to be lower under Alternative 4. No excessive levels were estimated under any tunnel segments provided that all ventilation fans are operational and in use during peak traffic conditions and there are no significant traffic tie-ups.

No significant effects from ventilation building emissions were estimated for receptors that are located more than 100 meters from the discharge points. Similarly, no excessively high 1-hour NO_2 concentrations were estimated for any receptors located at sidewalk level near the various ventilation buildings. Under Alternative 4, no excessively high NO_2 concentrations are anticipated for building air intakes in the South Bay and in the Pier No. 1 East Boston areas. In the Fort Point Channel area, however, air intakes on adjacent office buildings -- for example, the Harbor Plaza and the U.S. Customs building -- may be exposed to 1-hour NO_2 levels that could exceed 320 ug/m3.

Construction Impacts

Compared with Alternatives 2 and 3, the construction of this two-way Fort Point Channel tunnel is not expected to have as severe a traffic effect at Dewey Square. However, major effects (in terms of increasing congestion) are anticipated at Dorchester Avenue and West Broadway, Northern Avenue and Sleeper Street, and Atlantic Avenue and Northern Avenue during construction. The potential for either exacerbating an existing violation of the 8-hour CO standard and/or creating excessive 8-hour CO levels at these locations will therefore continue to exist under this alternative.

The construction effects of this alternative on air quality in East Boston are expected to be very similar to the effects described previously under Alternative 2.

As in all build alternatives, dust emissions and compliance with the 24-hour suspended particulate standard will continue to be a potential problem for areas along all truck routes and staging areas.

Mitigating Measures

No excessive CO concentrations were estimated at any of the receptors analyzed under this alternative. Therefore, no mitigating measures are needed.

In 1990, the NMHC emissions for

this alternative were estimated to be higher than the corresponding No-Build emissions by about 2 percent. By 2010, the NMHC emissions from Alternative 4 were estimated to be less than the corresponding No-Build emissions by about the same percentage. If mitigating measures were required for these small differences, then vehicle-miles-traveled reduction and/or improved level-of-service on heavily traveled arterials should be able to accomplish the necessary reduction in NMHC emissions in 1990.

Effects from toll plazas were found to be insignificant; therefore, no mitigating measures are required.

As with Alternatives 2 and 3, the air quality in the various tunnel segments is acceptable under design conditions. To prevent excessively high CO and NO_2 concentrations in the tunnel under non-design situations, the same set of mitigating measures described under Alternatives 2 and 3 could be implemented under this alternative as well.

One-hour NO_2 continues to be a potential problem for air intakes on office buildings in the immediate vicinity of the proposed ventilation building at Fort Point Channel. Therefore, the mitigating measures described under the other build alternatives are also applicable here.

Excessively high 8-hour CO concentrations could result during the construction period. Traffic control measures to relieve congestion, and to re-route traffic away from areas with a known CO problem should be considered to minimize this potential impact.

A potential dust problem is likely to occur during the construction period at both South Bay, Fort Point Channel, and the railroad right-of-way in East Boston. Therefore, the procedures to minimize these effects, as described under Alternative 2, should be implemented under this alternative as well.

4.6.5 Alternative 5

Long-Term Impacts

Emissions

As shown in Table 38, CO emissions under Alternative 5 are the lowest among all five alternatives examined. Compared with the No-Build Alternative, the NO_x emissions under Alternative 5 are slightly higher in 1990 and lower in 2010. The 1990 NMHC emissions were estimated to be the same for these two alternatives. By 2010, however, the NMHC emissions under Alternative 5 were estimated to be 6 percent lower than the corresponding No-Build emissions.

CO Levels

No excessively high 1-hour CO concentrations were estimated at any receptor locations under Alternative 5. The highest concentration of 14 ppm, estimated at the tennis courts adjacent to Storrow Drive, is still well under the 35-ppm standard. Compared with the No-Build Alternative, dramatic improvements in CO levels were estimated for receptors located near both the Sumner and the Callahan tunnel portals.

Under Alternative 5, maximum 8-hour CO concentrations were estimated to range from about 3 to 8 ppm in 1990. The concentrations were projected to decrease with time. No violation of the 8-hour standard is found anywhere.

Toll Plazas

The maximum 8-hour CO concentrations due to emissions from motor vehicles at the toll plazas under Alternative 5 in 1990 and in 2010 are both below 0.5 ppm. These concentrations were estimated for a receptor located at Porzio Park. The 1-hour NO_2 concentrations at this same receptor were estimated at about 12 ug/m^3 in 1990 and 22 ug/m^3 in 2010. Both the CO and the NO_2 concentrations are insignificant when measured against the 8-hour CO

standard of 9 ppm and the proposed EPA standard for NO_2. Differences between the open and semi-open configurations are small.

Tunnel Ventilation

Maximum 1-hour CO and NO_2 concentrations in the various tunnel segments for Alternative 5 are shown in Tables 42 and 43. The concentrations are very similar to the corresponding concentrations from Alternative 4 for the tunnel segments at the South Bay, the Fort Point Channel areas, and the Dewey Square tunnels. At Jeffries Cove, and in the Sumner and Callahan Tunnels, the concentrations under Alternative 5 are similar to the corresponding concentrations under Alternative 3. The 1990 1-hour CO concentrations were estimated to range from about 18 to 36 mg/m^3, and the 1990 1-hour NO_2 concentrations from about 1500 to 3500 ug/m^3. These concentrations are acceptable because of the short exposure time in using these tunnel segments.

Like all of the other build alternatives examined, maximum 1-hour NO_2 concentrations from ventilation building emissions for receptors that are located more than 100 meters away are generally quite low. For receptors that are located at sidewalk level, the highest 1990 1-hour NO_2 concentrations were estimated at about 150 ug/m3 near proposed Vent V1 in the Fort Point Channel (Northern Avenue) area. For receptors that are located at rooftop air intakes, no excessive levels are anticipated in the South Bay or Jeffries Cove areas. However, because of the proximity of other office buildings to Vent V1, air intakes on these buildings in the Fort Point Channel area could be exposed to 1-hour NO_2 concentrations that are in excess of 320 ug/m^3.

Construction Impacts

As in Alternative 4, construction of this alternative could potentially lead to excessively high 8-hour CO concentrations at a number of locations such as Dewey Square, Dorchester Avenue and West Broadway, Northern Avenue and Sleeper Street, and Atlantic Avenue and Northern Avenue.

The construction of the tunnel at Jeffries Cove is expected to affect mostly receptor locations within the airport and near the airport. The potential adverse effects include high 8-hour CO concentrations due to possible traffic disruption at the Connector Road area, and high suspended particulate concentrations due to construction-related dust emissions.

Mitigating Measures

No violation of either the 1-hour or the 8-hour CO standards was found at any receptor locations. Therefore, no mitigating measures are necessary. NMHC emissions under Alternative 5 were estimated to be equal to the corresponding No-Build emissions in 2010. No mitigating measures to reduce NMHC emissions are proposed at this time. Similarly, no mitigating measures are needed for toll plaza emissions because the effects from toll plazas were estimated to be quite insignificant.

Air quality in the various tunnel segments was estimated to be acceptable at design conditions. To prevent excessively high CO and NO_2 concentrations in the tunnel during adverse traffic conditions or if the mechanical ventilation system malfunctions, the candidate mitigating measures described under Alternative 2 should also be considered under Alternative 5.

One-hour NO_2 concentrations at air intakes of nearby buildings continue to be a potential problem at the Fort Point Channel area. Consequently, those mitigating measures proposed to be considered for the other build alternatives should also be explored under Alternative 5.

Potentially high CO concentrations at certain locations

during the construction period could be alleviated by traffic control measures that are designed to minimize congestion and avoid re-routing traffic to areas that have a potential CO problem even before construction.

Mitigating measures for controlling dust emissions are related to enforcing construction specifications. These procedures are described under Alternative 2, Construction Impacts.

4.7 NOISE AND VIBRATION

4.7.1 Noise

No-Build Alternative

Future Noise

Estimates of noise for the No-Build Alternative are included here for comparison with existing noise levels and with estimates of total noise from the four build alternatives.

Long-term traffic noise was predicted at each of the 14 representative noise measurement sites (see Figure 19 and Tables 11 and 12), and also at one additional site, Waterfront (Christopher Columbus) Park (site 15). Predictions were made in accordance with current FHWA procedures (see Appendix 6). For traffic noise generated at toll plazas, the FHWA procedure was augmented with noise measurements adjacent to the Sumner/Callahan toll plaza (site 14).

Table 46 summarizes 2010 predicted noise levels at the 15 selected sites for the No-Build Alternative. Shown are the project contributions, the non-project contributions and the total for each site/alternative pair. Also included are existing measured (1982) noise levels, the FHWA Activity Category for each site and the site's corresponding Noise Abatement Criteria. Of the 14 sites where existing noise levels have been determined, two will experience decreases ranging from 2 to 8 dBA L_{eq} (sites 3 and 13), one site will not change (site 12), and the remaining 11 sites will experience increases ranging from 1 to 11 dBA. As indicated in Section 3.5, changes in noise levels are perceptible at approximately a 4 dBA change. Applying this criterion to changes in noise levels for the No-Build Alternative between 1982 and 2010, perceptible increases in noise levels will occur at 8 of 14 locations as follows: site 1 - Rotch Playground (11 dBA); site 2 - St. Peter and Paul Church (9 dBA); site 4 - Boston Tea Party Museum (10 dBA); sites 7, 8, 9 - Bremen Street residences near Porter Street (6-7 dBA); and sites 10 and 11 - East Boston Athletic Field (4-5 dBA).

Construction Impacts

The No-Build Alternative does not involve any project construction. Therefore, no adverse construction-noise effects are anticipated and no mitigating measures are required.

Alternative 2

General Analysis Approach

There are no locations for any alternatives 2 that have predicted noise levels which result in serious increases of 15 dBA or greater when compared to existing (1982) noise levels.

No Category-A sites were identified. Category-B sites include all park and playground sites, plus all residences with yard areas exposed directly to project noise (sites 1, 3, 4, 5, 10, 11, 13, and 14). Category-E sites include the church and those residential sites without exterior activities (sites 2, 6, 7, 8, 9, and 12). Impact assessment at the St. Peter and Paul Church assumed closed windows that provide an outdoor-to-indoor noise reduction of 25 decibels. Interior impact at the Category-E residences assumed open windows that provide an outdoor-to-indoor noise reduction of 10 decibels.

Where noise barriers are

identified as acoustically feasible, the acceptability and the reasonableness of the noise barriers has not yet been investigated, i.e., because of other factors, such as visual and vehicle sight distance considerations, these barriers may not be implemented. The desirability of noise barriers will be determined during subsequent phases of this project.

Future Noise

From Table 46, comparison of predicted total daytime year 2010 noise levels of Alternative 2 to the No-Build Alternative reveals that only two sites (site 4 - Boston Tea Party Museum and site 5 - Frankfort Street residence) will experience perceptible increases in total noise levels. At 6 sites, actual decreases will occur, though not perceptible. These decreases, due to traffic diversions from existing facilities, occur near the Callahan/Sumner toll plaza area and at Bremen Street residences in East Boston, Dockside Condominiums on Sleeper Street in South Boston, and Waterfront Park in Boston.

Noise from induced traffic was also investigated at locations along two streets in South Boston (D Street - between Old Colony Avenue and West First Street, and L Street - between Broadway and Columbia Road) and along two streets in East Boston (Sumner Street - between Orleans and Cottage Streets, and Chelsea Street - between Porter and Gove Streets). At these locations, traffic noise for the build alternatives is expected to be equal to or one decibel less than No-Build traffic noise, an imperceptible change.

Table 47 contains the projected noise levels from traffic associated with Alternative 2. Noise barriers have been examined and evaluated where either (1) the total projected noise exceeds the existing noise by more than 15 decibels, or (2) the total projected noise approaches or exceeds the relevant FHWA Noise Abatement Criterion. In total, noise barriers have been examined and evaluated for all sites except 2, 13 and 14.

Significant noise reduction of 5 decibels or more is not acoustically feasible at sites where non-project noise dominates over project noise. At such sites, even a complete elimination of project noise, through noise-barrier design, would result in a maximum of 3 decibels reduction in total noise. For Alternative 2, such sites consist of sites 7 through 12 and 15.

At site 1, a noise reduction of 10 decibels can be achieved only with a 10-foot high noise barrier along the edge of the highway structure, for a length of approximately 1500 feet, plus a 10-foot high ramp barrier 400 feet long, plus an at-grade 10-foot high barrier along Albany Street, wrapping around at the two adjacent streets (see Figure 37). At site 3, a marginally effective barrier could run at grade along the near side of relocated Dorchester Avenue, for the entire length between Sumner Street and relocated Northern Avenue. Noise reduction here is limited to approximately 4 decibels, because of unmitigated local-street noise. This barrier is not sufficiently effective to be included in Table 47. At site 4, 6 decibels of total noise reduction is acoustically feasible with a 15-foot high barrier for 800 feet along the east side of relocated Dorchester Avenue, plus a merging 10-foot high barrier for 200 feet along Congress Street. At site 5, a 15-foot high barrier along the near edge of the toll plaza can reduce project noise significantly (9 to 12 decibels) even to the upper floors. For a fully open toll plaza, such a barrier would also protect receptors on Orleans Street, southwest of Gove Street. At site 6, a 20-foot high barrier along the near edge of the depressed, open toll plaza can reduce project noise significantly (8 to 13 decibels) even to the upper floors of nearby buildings. Its effect upon noise here is limited to 5 decibels. Normally, a maximum 5-decibel reduction in total noise would not be sufficient to justify a barrier.

Table 46

SUMMARY COMPARISON OF ALTERNATIVES, WITHOUT NOISE BARRIERS, YEAR 2010

		Daytime Hourly L_{eq} (dBA)**																FHWA Activity Category	FHWA Noise Abatement Criterion[1]
Site No.*	Description	Existing	Alt. 1 P	Alt. 1 N	Alt. 1 TOT	Alt. 2 P	Alt. 2 N	Alt. 2 TOT	Alt. 3 P	Alt. 3 N	Alt. 3 TOT	Alt. 4 P	Alt. 4 N	Alt. 4 TOT	Alt. 5 P	Alt. 5 N	Alt. 5 TOT		
1	Rotch Playground	69	-	80	80	80	<65	80	80	<65	80	74	80	81	74	80	81	B	67
2	St. Peter and Paul Church	63	-	72	72	71	63	72	71	63	72	67	63	68	67	63	68	E	77
3	Dockside Condominiums	73	-	71	71	69	65	70	72	65	73	62	64	66	62	64	66	B	67
4	Boston Tea Party Museum	65	-	75	75	79	73	80	79	73	80	73	72	76	73	72	76	B	67
5	Frankfort St. Residence	57	-	58	58	66	54	66	<50	58	58	66	54	66	<50	58	58	B	67
6	Bremen St. Residence south of Porter St. (First Floor)	68	-	68	68	72	68	73	<55	68	68	72	68	73	<55	68	68	E	62
7	Bremen St. Residence south of Porter St.	73	-	79	79	70	76	77	<55	79	79	70	76	77	<55	79	79	E	62
8	Bremen St. Residence north of Porter St.	69	-	75	75	66	73	74	61	75	75	66	73	74	61	75	75	E	62
9	Bremen St. Residence north of Porter St.	68	-	75	75	66	72	73	66	74	75	66	72	73	61	74	75	E	62
10	East Boston Rec. Area	65	-	69	69	66	68	70	65	68	70	66	68	70	65	68	70	B	67
11	East Boston Rec. Area	67	-	72	72	65	72	73	62	72	72	65	72	73	62	72	72	B	67
12	Maverick Street Res.	64	-	64	64	<55	64	64	56	64	65	<55	64	64	56	64	65	E	62
13	Porzio Park	69	-	61	61	<50	61	61	58	61	63	<50	61	61	58	61	63	B	67
14	Sumner-Callahan Toll Plaza	75	-	78	78	<55	76	76	<55	77	77	<55	76	76	<55	77	77	--	--
15	Waterfront Park	--	-	81	81	<55	77	77	66	80	80	<55	77	77	<55	80	80	B	67

* For sites 1-14, see Fig. 19

** P=Project contribution; N=Non-project contribution; TOT=Total

1 dBA L_{eq}

However, here this barrier is likely to be built to protect adjacent receptors from the toll-plaza noise only, which is potentially more annoying than local-street noise. Note that every vehicle must accelerate (the prime factor in the resulting noise levels) after passing through a toll booth.

Construction Impacts

For the construction of Alternative 2, the major sources of noise will be pile driving, slurry-wall construction, and trucking. Assessment of temporary construction noise effects is accomplished by comparing prototype construction noise predictions at sensitive receptor locations with existing noise levels. The results of this exercise are summarized below for Alternative 2.

A review of the planned construction indicates that, compared to existing noise levels, minor impact (5-10 dBA increase) from construction noise is expected at the Rotch Playground, the East Boston Memorial Stadium, and at Bremen Street residences north of Porter Street. Moderate impact (10-15 dBA increase) is expected at Harbor Towers. Substantial impact (greater than 15 dBA increase) is expected at the Boston Tea Party Museum and at Bremen Street residences south of Porter Street.

Potential mitigation techniques for construction noise include limiting construction activity to daytime hours, ensuring that all diesel-powered equipment has effective mufflers, and erecting temporary noise barriers between construction operations and sensitive receptor locations. Use of alternative construction methods (e.g., using vibratory instead of impact pile drivers) could also reduce construction noise. Feasibility of such mitigation has not yet been established, since such feasibility depends upon the detailed construction equipment and scenarios planned for the project.

Alternative 3

Future Noise

From Table 46, comparison of predicted total daytime year 2010 noise levels of Alternative 3 to the No-Build Alternative reveals that only one site (Boston Tea Party Museum) will experience perceptible increases in total noise levels. Two sites, Callahan/Sumner Toll Plaza in East Boston and Waterfront Park in Boston, will actually experience decreases, though not perceptible. The only perceptible total noise level difference between Alternatives 2 and 3 is at the Frankfort Street residence (site 5) in East Boston, which is attributable to the location of the Alternative 2 toll plaza (eight dBA higher than Alternative 3).

Table 47 contains the projected noise levels from traffic associated with Alternative 3. By the criteria stated above, noise barriers have been examined and evaluated for all sites except 2, 5, 13 and 14. Because non-project noise dominates over project noise, significant noise reduction is not acoustically feasible for Alternative 3 at sites 6 through 12, and 15. Site 1 mitigation is identical with Alternative 2. At site 3, approximately 7 decibels of noise reduction is acoustically achievable with a 15-foot high barrier for 1000 feet along relocated Dorchester Avenue, plus a 20-foot high barrier for approximately 1000 feet along the edge of the Central Artery, as it rises onto viaduct structure past relocated Northern Avenue (see Figure 37). Site 4 mitigation is identical with Alternative 2.

Construction Impacts

For the construction of Alternative 3, the major sources of noise would be pile driving of sheet piles or bearing piles, as well as trucking.

A review of the planned

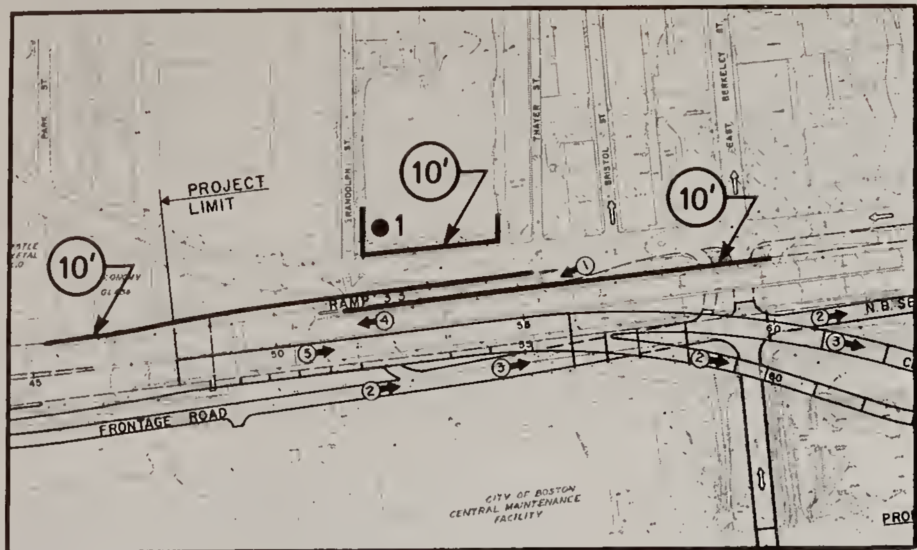
Table 47

MODIFIED COMPARISON OF ALTERNATIVES, WITH NOISE BARRIER

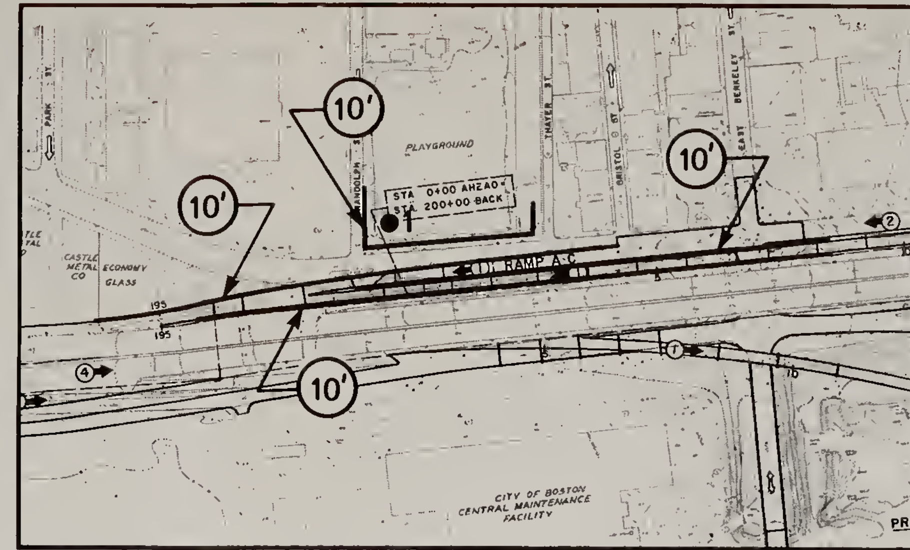
Site No.*	Description	Existing	Alt. 2 P	Alt. 2 N	Alt. 2 TOT	Alt. 3 P	Alt. 3 N	Alt. 3 TOT	Alt. 4 P	Alt. 4 N	Alt. 4 TOT	Alt. 5 P	Alt. 5 N	Alt. 5 TOT	FHWA Activity Category	FHWA Abatement Criterion (dBA L_{eq})
1	Rotch Playground	69	80 -10 70	<65 -5 <60	80 70	80 -10 70	<65 -5 <60	80 70	74 -10 64	80 -10 70	81 71	74 -10 64	80 -10 70	81 71	B	67
3	Dockside Condominiums	73				72 -11 61	65 65	73 66							B	67
4	Boston Tea Party Museum	65	79 -11 68	73 73	80 74	79 -11 68	73 73	80 74							B	67
5	Frankfort Street Residence (first floor)	57	66 -12 54	54 54	66 57				66 -12 54	54 54	66 57				B	67
6	Bremen St. Residence south of Porter St. (first floor)	68	72 -12 60	68 68	73 68				72 -12 60	68 68	73 68				B	62

* For site location, see Fig. 19

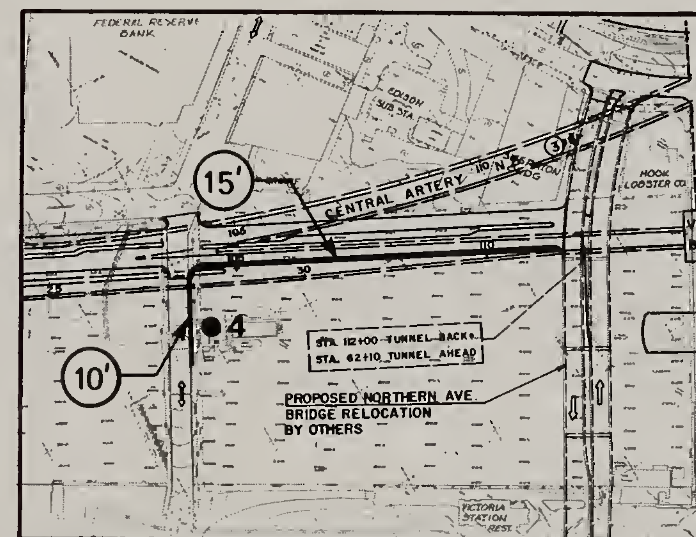
** P=Project Contribution; N=Non-project contribution; TOT=Total



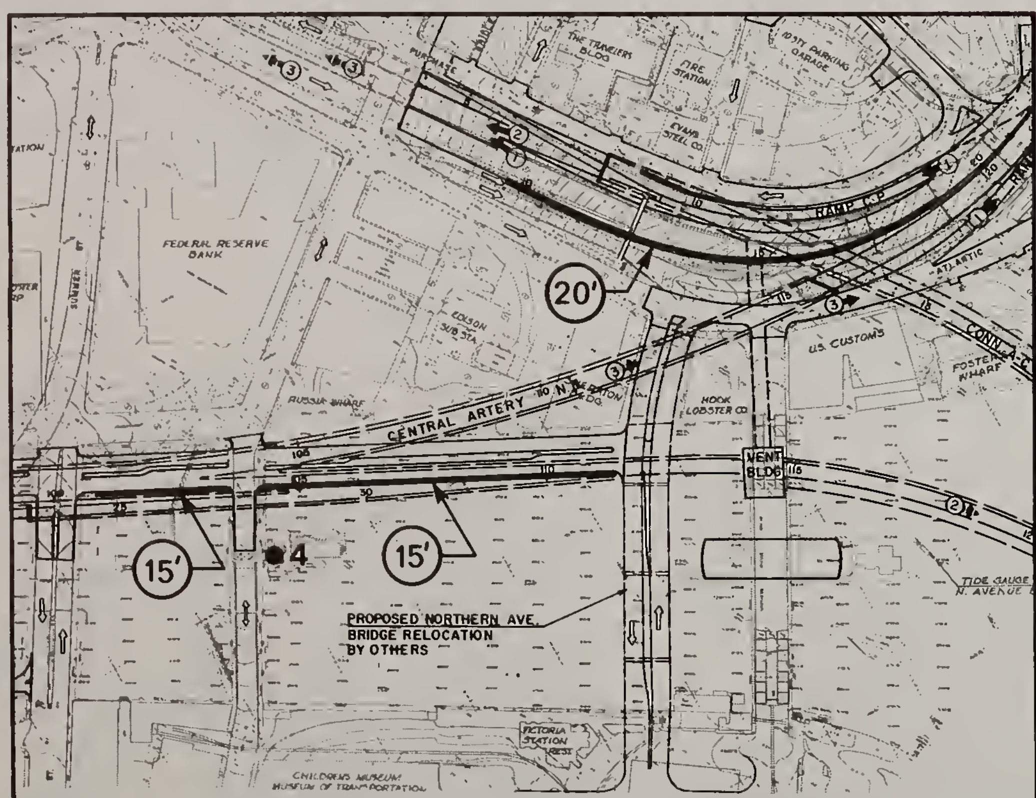
Site 1, Alternatives 2 & 3



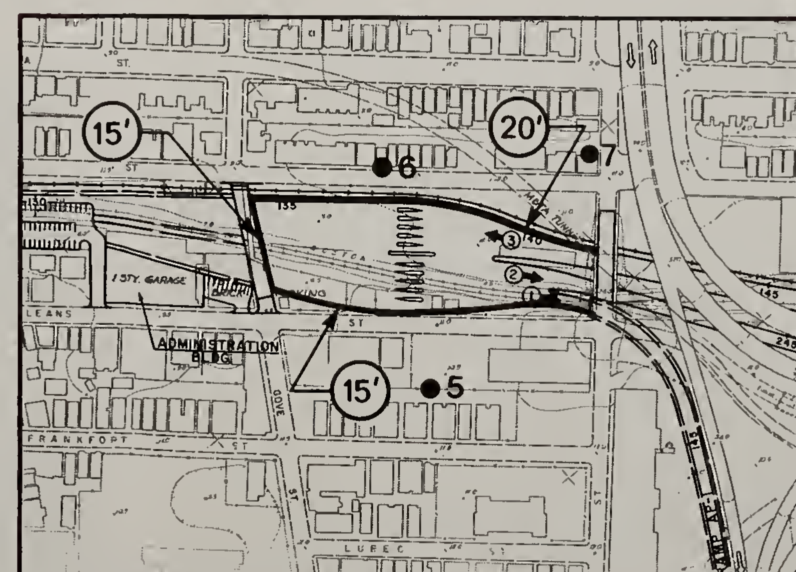
Site 1, Alternatives 4 & 5



Site 4, Alternatives 2 & 3



Site 3, Alternative 3



Site 5, Alternatives 2 & 4

Figure 37
Feasible Noise Barrier Locations

0 100 200 400 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend
Noise Barrier
•1 Existing Noise Measurement Location

construction indicates that, compared to existing noise levels, minor impact from construction noise is expected at the Rotch Playground, and residences at the eastern end of Maverick Street. Moderate impact is expected at Harbor Towers and the East Boston Recreation Area. Substantial impact is expected at the Boston Tea Party Museum.

Potential mitigation techniques are the same as for Alternative 2.

Alternative 4

Future Noise

From Table 46, only one site, the Frankfort Street residence in East Boston, will experience a perceptible increase in year 2010 noise level under Alternative 4 as compared to the No-Build Alternative. Like Alternative 2, this perceptible increase relates to the presence of the toll plaza of the railroad alignments. Seven of the 14 sites will experience noise level decreases as compared to the No-Build, including perceptible decreases at St. Peter and Paul Church, Dockside Condominiums, and Waterfront Park on the Boston side. Perceptible noise decreases occur for the two-way alignments (Alternatives 4 and 5) as compared to the split alignment (Alternatives 2 and 3) at the Broadway/South Boston and Fort Point Channel sites (2, 3, and 4).

Table 47 contains the projected noise levels from traffic associated with Alternative 4. By the criteria stated above, noise barriers have been examined and evaluated for all sites except 2, 13 and 14. Because non-project noise dominates over project noise, significant noise reduction is not acoustically feasible, for Alternative 4 at sites 3, 7 through 12, and 15. Technically, this is true also for site 1. However, since the same barriers will work equally well at site 1 for this alternative as for the previous alternatives, site 1 is considered here.

Site 1 mitigation is essentially identical to Alternative 2. At site 4, noise barriers can produce no significant noise reduction, because of unmitigated noise from non-project streets. Mitigation for sites 5 and 6 are identical with Alternative 2.

Construction Impacts

For the construction of Alternative 4, the major sources of noise would be pile driving, slurry-wall construction, and trucking.

A review of the planned construction indicates that, compared to existing noise levels, minor impact from construction noise is expected at one apartment building in the Albany Street area, at the East Boston Recreation Area, and at Bremen Street residences north of Porter Street. Moderate impact is expected at the Rotch Playground. Substantial impact is expected at the Boston Tea Party Museum and at Bremen Street residences south of Porter Street.

Potential mitigation techniques are the same as for Alternatives 2 and 3.

Alternative 5

Future Noise

From Table 46, Alternative 5 will result in no perceptible noise increases at any locations as compared to the No-Build Alternative; perceptible noise decreases will occur at two sites, St. Peter and Paul Church and Dockside Condominiums in South Boston, and imperceptible decreases at two others. Alternative 5 will have the same perceptible noise decreases in the Broadway/South Boston and Fort Point Channel areas as Alternative 4 (sites 2, 3, and 4), when compared to the split-alignment alternatives (Alternatives 2 and 3). It will also have the same perceptible noise level decrease at the Frankfort Street residence as Alternative 3 (airport alignments) when compared to the railroad alignments (alternatives

2 and 4) in East Boston.

Table 47 contains the projected noise levels from traffic associated with Alternative 5. By the criteria stated above, noise barriers have been examined and evaluated for all sites except 2, 5, 13 and 14. Because non-project noise dominates over project noise, significant noise reduction is not acoustically feasible, for Alternative 5, at sites 3, 6 through 12, and 15. Site 1 mitigation is essentially identical to Alternative 2. At site 4, noise barriers can produce no significant noise reduction, because of unmitigated noise from non-project streets.

Construction Impacts

For the construction of Alternative 5, the major source of noise would be pile driving of sheet piles or bearing piles, as well as trucking.

A review of the planned construction indicates that, compared to existing noise levels, minor impact due to construction noise is expected at one apartment building in the Albany Street area and at residences at the eastern end of Maverick Street. Moderate impact is expected at the Rotch Playground and the East Boston Recreation Area. Substantial impact is expected at the Boston Tea Party Museum.

Potential mitigation techniques are the same as for Alternatives 2, 3, and 4.

4.7.2 Vibration

No-Build Alternative

There are no vibration impacts of the No-Build Alternative.

Alternative 2

Long-Term Effects

No significant long term (i.e., traffic) vibration effects would be anticipated from implementation of Alternative 2. The only possible exception would be if the roadway surface in the vicinity of the toll plaza were allowed to deteriorate seriously creating vibration annoyance to nearby residences (peak velocity of 0.017 in/sec.). However, such a problem could be avoided by maintenance of smooth roadway surfaces.

Construction Impacts

For the construction of Alternative 2, the major sources of vibration would be pile driving and slurry wall construction. Exposure to vibration from these construction sources could occur for periods ranging between one month and one year, depending on sensitive receptor location. Potential effects of construction-related vibration include damage to structures, annoyance to people, and disruption of sensitive equipment operation. Assessment of such effects is accomplished by comparing predicted construction vibrations at sensitive receptor locations with project vibration criteria (see Sec. 3.5.2 and Appendix 6 - Part II). The results of this exercise are summarized below for construction of Alternative 2.

A review of the planned construction indicates the potential for vibration-induced structural damage at only one building in the project area (Hook Lobster Company) during sheet piling operations within 6 feet of this building (peak velocity about 2 in./sec.). For construction near the MBTA subway tunnels, vibration levels are not expected to exceed the project criterion for structural damage effects (peak velocity of 1.9 in./sec). However, pile driving within about 90 feet of the Red Line tunnel in Fort Point Channel and within about 40 feet of the Blue Line tunnel in East Boston could result in tunnel ceiling vibrations exceeding the measured existing maximum vibrations from train operations. In terms of minor architectural damage, analysis estimates indicate that the project

vibration criterion for historic buildings (peak velocity of 0.08 in./sec) would be exceeded at five buildings (including the Children's Museum) in the Boston Wharf Company Warehouse District.

Temporary annoyance from Alternative 2 construction vibration would be likely to occur at Harbor Towers, the Dockside Condominiums and Children's Museum at Museum Wharf on the Boston side, and the Heritage Apartments, Dante Alighieri School, Our Lady of Mount Carmel Church, and about 380 triple-decker residential buildings in East Boston. In addition, annoyance effects are anticipated during construction near approximately 26 office or commercial buildings and eight factory or industrial buildings. The most severe annoyance to residents of the area is expected during about three months of sheet piling for the proposed toll plaza. Maximum ground vibration velocities outside the nearest residential buildings could be about 0.17 in./sec during this operation, which is three to four times as great as existing ground vibrations measured above the MBTA Blue Line subway tunnel in this area. Maximum vibration velocities inside these buildings could be as high as 0.3 in./sec, characterized as "unpleasant." At other affected residential locations, maximum construction vibrations could be characterized as "easily to strongly noticeable." Based on an average of two people per residential unit, it is estimated that approximately 3,100 people living in the project area would be disturbed by vibration during some portion of the construction period for Alternative 2.

The effects of construction vibration on sensitive equipment operation are of particular concern at the Gillette Company facilities in South Boston. The present evaluation indicates that vibrations from pile driving for the supports of Gillette's extended water intake pipe could exceed maximum existing building vibrations at only 2 of 11 sensitive locations. This effect could occur for a period of about one month, with a maximum peak floor vibration velocity of about 0.045 in./sec at the nearest sensitive building location.

Potential mitigation techniques for the above vibration effects include water jetting and pre-trenching in the case of sheet piling and pre-augering and the use of low-displacement piles in the case of bearing pile driving. Methods for mitigating vibration from slurry wall construction are limited to the use of careful construction practices to minimize impacts between the slurry wall bucket and the ground. Additional means to avoid adverse effects include scheduling construction to minimize sensitive activity interference. The feasibility and effectiveness of such methods, however, depend on site-specific parameters. Additional details regarding the assessment and mitigation of construction vibration are contained in Appendix 6.

Alternative 3

Long-Term Effects

No significant long-term (i.e., traffic) vibration effects are anticipated from implementation of Alternative 3, even if project roadway surfaces were allowed to deteriorate seriously. Therefore, no mitigating measures are required for long-term vibration effects.

Construction Impacts

For the construction of Alternative 3, the major source of vibration would be pile driving of sheet piles or bearing piles. Exposure to pile driving vibration could occur for periods ranging between one month and one year, depending on sensitive receptor location. The assessment of potential vibration effects is summarized below for construction of Alternative 3.

A review of planned construction indicates the potential for vibration-induced structural

damage and minor architectural damage are the same as Alternative 2 on the Boston side of the Harbor. The effects of construction vibration on the Gillette Company facilities is also the same as Alternative 2.

Temporary annoyance from Alternative 3 construction vibration would be likely to occur at Harbor Towers, the Dockside Condominiums, and Children's Museum at Museum Wharf on the Boston side, and at the Hilton Hotel, as well as at about 40 triple-decker residential buildings in East Boston. In addition, annoyance effects could occur during construction near approximately 27 office or commercial buildings and 4 factory or industrial buildings. Maximum vibration velocities inside the nearest residential buildings could range between 0.05 and 0.09 in./sec, characterized as "easily to strongly noticeable." Based on an average of 2 people per residential unit, it is estimated that approximately 460 people living in the project area would be disturbed by vibration during some portion of the construction period for Alternative 3.

Potential mitigation techniques are the same as for Alternative 2.

Alternative 4

Long-Term Effects

No significant long-term (i.e., traffic) vibration effects would be anticipated from implementation of Alternative 4. The only possible exception would be if the roadway surface in the vicinity of the toll plaza were allowed to deteriorate seriously creating annoyance effects (peak velocity of 0.017 in./sec.), which could be avoided by maintenance of a smooth roadway surface.

Construction Impacts

For the construction of Alternative 4, the major sources of vibration would also be pile driving and slurry wall construction. Exposure to vibration from these construction sources could occur for periods ranging between 1 and 8 months, depending on sensitive receptor location.

Ground vibrations from construction activity are not expected to exceed the project criterion for structural damage (peak velocity of 1.9 in./sec) at any building or structure in the project area. However, as with previous build alternatives, pile driving within about 90 feet of the MBTA Red Line subway tunnel in Fort Point Channel and within about 40 feet of the MBTA Blue Line subway tunnel in East Boston could result in tunnel ceiling vibrations exceeding the measured existing maximum vibrations from train operations. In terms of minor architectural damage, analysis estimates indicate that the vibration criterion for historic buildings (peak velocity of 0.08 in./sec) would be exceeded at five buildings (including the Children's Museum) in the Boston Wharf Company Warehouse District and at three industrial buildings in the Albany Street area.

Temporary annoyance from Alternative 4 construction vibration would be likely to occur at one apartment building in the Albany Street area, at the Dockside Condominiums, and at the Children's Museum at Museum Wharf on the Boston side, and at the Heritage Apartments, Dante Alighieri School, Our Lady of Mount Carmel Church, as well as at about 380 triple-decker residential buildings in East Boston. In addition, annoyance effects are anticipated during construction near approximately 13 office or commercial buildings and 14 factory or industrial buildings. The most severe annoyance to residents of the area would be expected during about three months of sheet piling for the proposed toll plaza as described in Alternative 2. Based on an average of two people per residential unit, approximately 3,030 people living in the project area would be disturbed by vibration during some portion of the construction period for Alternative 4.

The effects of construction vibration on the Gillette Company facilities are the same as for Alternatives 2 and 3.

Potential mitigation techniques for the above vibration effects include those described previously for the other build alternatives.

Alternative 5

Long-Term Effects

No significant long-term (i.e., traffic) vibration effects are anticipated from implementation of Alternative 5, even if project roadway surfaces were allowed to deteriorate seriously. Therefore, no mitigating measures are required for long-term vibration effects.

Potential for vibration induced structural damage and minor architectural damage is the same as for Alternative 4.

Construction Impacts

Temporary annoyance from Alternative 5 construction vibration would be likely to occur at one apartment building in the Albany Street area, at the Dockside Condominiums, and at the Children's Museum at Museum Wharf on the Boston side, and at the Hilton Hotel as well as about 40 triple-decker residential buildings in East Boston. In addition, annoyance effects are anticipated during construction near approximately 14 office or commercial buildings and 10 factory or industrial buildings. Maximum vibration velocities inside the nearest residential buildings could range between 0.04 and 0.09 in./sec; characterized as "easily to strongly noticeable." Based on an average of two people per residential unit, it is estimated that approximately 390 people living in the project area would be disturbed by vibration during some portion of the construction period for Alternative 5.

The effects of construction vibration on the Gillette Company facilities are the same as for Alternative 2.

Potential mitigation techniques are the same as for previous build alternatives.

4.8 WATER RESOURCES

4.8.1 Impacts from the No-Build Alternative

The No-Build Alternative, by not involving project construction, will have neither short- nor long-term water quality impacts and there would be little alterations, other than through natural processes to marine biota. Planned water quality improvement projects such as the Fort Point Channel CSO treatment facility can be completed with or without the Third Harbor Tunnel. Coordination has been conducted with State and Federal agencies, including EOEA, DEQE, EPA, Corps of Engineers, National Marine Fisheries, and U.S. Fish and Wildlife Service. The results of this coordination was the implementation of background data gathering on marine sediments, and the methods and locations for bioassay analysis.

4.8.2 Hydrologic Impacts

Hydrologic effects of construction of the Third Harbor Tunnel will include slight reductions in the volume of Boston Harbor and in the tidal prism. Neither proposed tunnel alignment will directly encroach on the Harbor itself, since the tunnel will be placed below the bottom of the Harbor, but both will occupy water surface area and tidal volume in Fort Point Channel. Table 48 shows the existing water volumes, prism, and flushing time of the Channel and the changes associated with the airport (Alternatives 3 and 5) and railroad (Alternatives 2 and 4) alignments. In the Fort Point Channel, the reductions in water volume are moderate (approximately 37 percent), but lead to only minor increases in average flushing time. Although 37 percent of the tidal prism

Table 48

HYDROLOGIC IMPACTS ON FORT POINT CHANNEL

	Existing (Alternative 1)	Railroad Alignment (Alternatives 2 & 4)	Airport Alignment (Alternatives 3 & 5)
Water Volumes (ft^3)			
Mean Low Water (mlw)	24,090,000	19,860,000	19,810,000
Mean Sea Level (msl)	34,730,000	26,200,000	26,510,000
Mean High Water (mhw)	45,590,000	33,030,000	33,380,000
Prism - Mean (ft^3)	21,510,000	13,480,000	13,550,000
% Reduction of Prism		37	37
Flushing Time (Tidal Cycles)	2.12	2.47	2.46

in the Fort Point Channel would be displaced by the new tunnel, the coincidental lack of change in the ratio between the total amount of water (at mean high water) and the volume of the tidal prism leads to only a small change in flushing. Considering the Harbor as a whole, the decreases in the Fort Point Channel tidal prism will lead to a reduction of approximately 1.5 percent in the 518 million cubic foot Harbor tidal prism and to immeasurably small increases in total Harbor flushing times. Thus, the physical effects of the Third Harbor Tunnel project on water volumes and flushing of Boston Harbor can be characterized as negligible, regardless of the alternative selected.

4.8.3 Chemical Impacts of Construction

Short-term chemical impacts to water resources will result primarily from sediments suspended during the dredging. The extent of these effects was determined through the application of a dispersion model developed by the Corps of Engineers. The modeling was used to determine potential conditions in Boston Harbor, with the assumption of continuous (24 hours a day) dredging at a rate of 10,000 cubic yards per day with clam shell dredges. No dredging will take place during the flounder spawning season (February 1 to May 15).

Impacts Along the Airport Alignment (Alternatives 3 and 5)

The results of the dispersion modeling indicate that during the dredging of Harbor mud and clays along the airport alignment, suspended solids concentrations will be raised in the areas indicated on Figure 38. The isopleths (a type of contour) plotted illustrate the extent and concentration of suspended sediment during dredging for the tunnel construction. This is estimated to be 250 working days. The width of the actual plume on any tidal cycle will be approximately 110 meters and will not obstruct a significant portion of Harbor width for fish passage. Since the concentrations presented on Figure 38 are averaged vertically, the maximum concentration near the bottom can be expected to be from two times the average (near the dredging activity) to four times the average near the limits of the plume. Parallel determinations of the concentration of sediment-associated metals and other contaminants indicated that these would be, for the most part, in the parts per billion range. No detectable concentrations of PCBs or pesticides will be present. Nutrients, especially total Kjeldahl nitrogen, may be somewhat elevated within the plume, but will rapidly return to background levels.

Following excavation for the sections, the placement of the foundation course, backfilling after sections are in place, and stone riprap will amount to 750,000 cubic yards for the airport alignment. Backfill materials will have a range of fines (passing a 200 mesh sieve) of 10-15 percent. Placement of the foundation and backfill materials will be under controlled conditions and will most likely be by the tremie method (direct underwater introduction of materials through a tube-like device).

Impacts Along the Railroad Alignment (Alternatives 2 and 4)

Because the sediments along the railroad alignment are similar to those along the airport alignment, the short-term effects on water quality are expected to be essentially identical. Figure 39 presents the extent of elevated suspended solids concentrations and the form of the plume on an individual tide cycle. This alignment extends further into the Inner Harbor than the airport alignment. Consequently, the maximum extent of the sediment plume will extend further, reaching the junction of the Charles River and the Boston Inner Harbor.

Because of the reduced length of the railroad alignment options, the

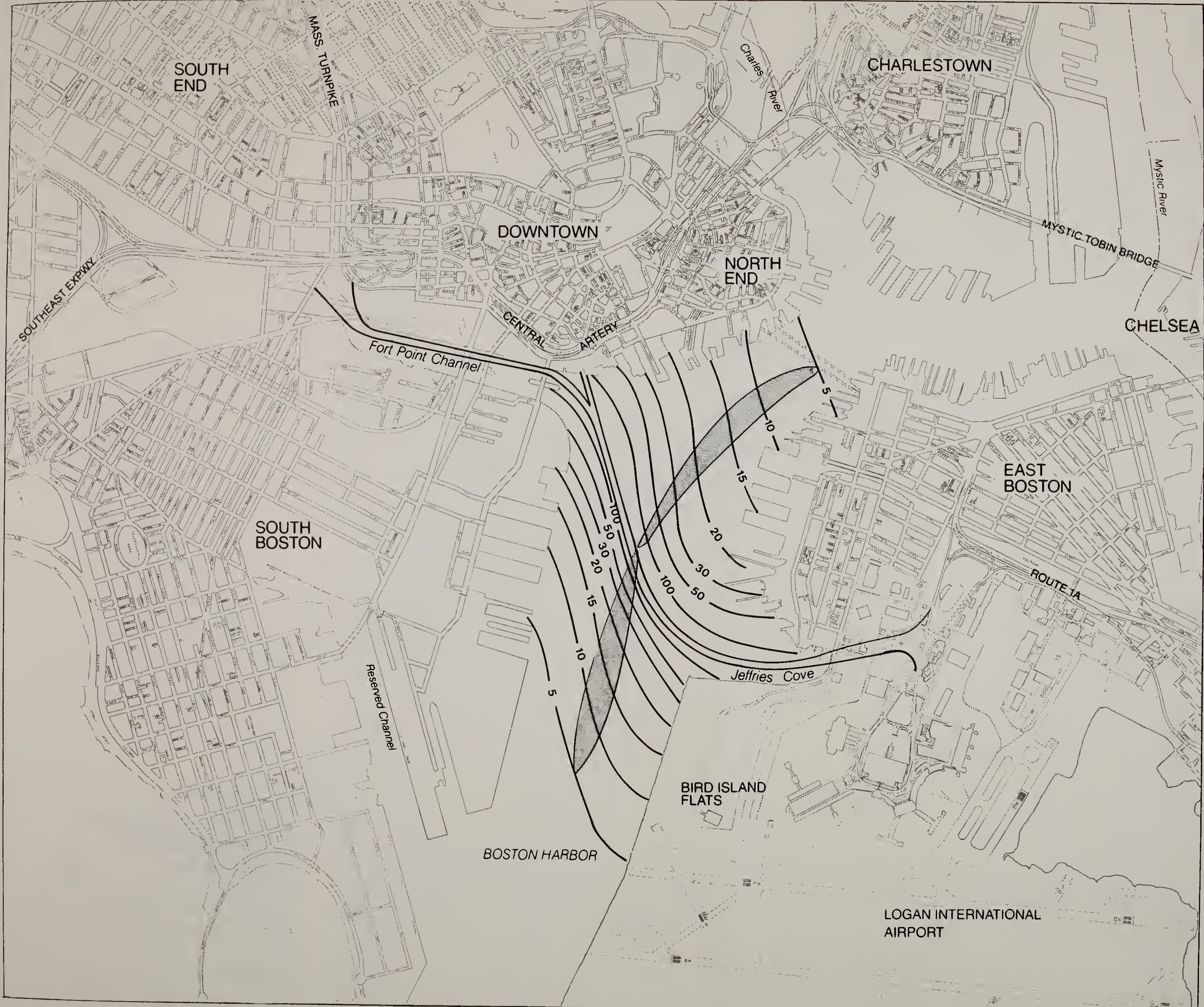


Figure 38
Suspended Sediments — Airport Alignment

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend

Typical Plume

Incremental Concentration (Mg/l)

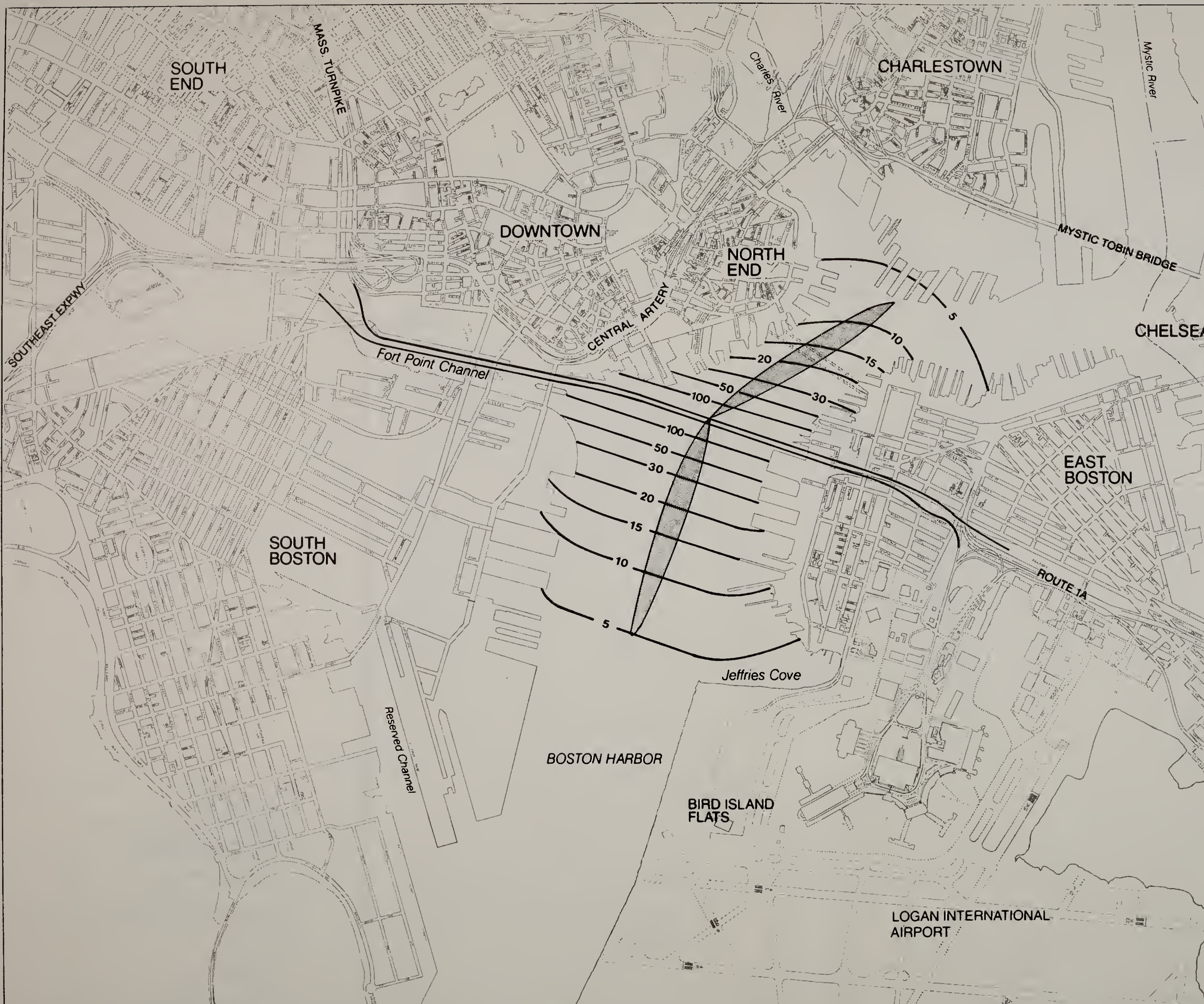


Figure 39
Suspended Sediments — Railroad Alignment

0 450 900 1800 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Legend

Typical Plume

0 Incremental Concentration (Mg/l)

total area affected by suspended sediments is reduced considerably, as is the total time of exposure. The railroad alignment will require approximately 170 days of dredging, as compared to 250 days for the airport alignment alternatives. This difference indicates that qualitatively, the railroad alignment options will have less impact on the water quality of the Harbor than the airport alignment.

As with the airport alignment alternatives, the railroad alignments will require the placement of 500,000 cubic yards of material (tunnel backfill, riprap, etc.) under carefully controlled conditions.

Impacts in Fort Point Channel (All Build Alternatives)

Both tunnel alignments will require fill to be placed in Fort Point Channel. This filled section will be constructed within steel sheet pile walls, thus limiting the short-term effects on water quality to those associated with driving the steel sheeting. These effects will be relatively minor compared to the effects of the dredging activity in the Harbor. Since the chemical effects of the dredging will be minor, it can be said with certainty that the effects of pile driving in Fort Point Channel will also be small. Maneuvering of barges and tug boats in the Channel will lead to temporary increases of suspended solids through prop wash. The use of an impervious material in the water such as a silt curtain to contain suspended sediment will be considered. (A silt curtain is a reinforced rubberized fabric sheet which generally extends several feet off the bottom, is supported by floatation booms, and is conventionally used in dredging operations to control the dispersion of suspended particles. At the water surface, a silt curtain resembles an oil containment boom.)

4.8.4 Long-Term Impacts of the Build Alternatives

All four build alternatives will not have significant effects on long-term water quality or marine ecology. They will, however, reduce the tidal prism of the Fort Point Channel by approximately 37 percent. This would have an adverse long-term effect on use of water within the Channel by the Gillette Company.

As discussed previously in Section 3.6.3, the Gillette Company operates a major cooling water intake and discharge just to the east of Dorchester Avenue, with a maximum use rate of 39 mgd. Construction of the Third Harbor Tunnel will necessitate filling of the Fort Point Channel and relocating the Roxbury Canal Conduit to within 250 feet of the Gillette intake and will reduce the tidal volume of Fort Point Channel by approximately 8.0 million cubic feet. Since the facility now operates at or near its temperature limit in the summer, these reductions in available volume would preclude adequate cooling unless the intake and/or the discharge were relocated. Both have been considered and, as part of the Third Harbor Tunnel project, it is proposed to relocate the cooling water intake to the vicinity of Northern Avenue. This will provide lower temperature cooling water than at present, thereby increasing cooling efficiency and reducing the net thermal impact to Fort Point Channel.

Two lobster companies (Hook Lobster and Neptune Seafood) require water for the maintenance of their lobster stocks in holding tanks. Provisions will be made in the final design of the Third Harbor Tunnel to assure these users of an uninterrupted supply of Harbor water. Thus, no long-term negative effects on these users can be expected.

4.8.5 Short-Term Biological Impacts

Marine benthic organisms inhabiting the sediment within all the build alignments will be lost during dredging. There will also be some mortality to fish within the

alignments attributable to physical damage from dredging and adverse water quality conditions (suspended sediment) actually within the dredge area. Outside the area of the plume, no impacts to marine life are anticipated.

After placement, tunnel sections will be covered with gravel and riprap and recolonization of the bottom by marine organisms will commence. The bottom areas covered with the gravel and riprap will constitute a new and more desirable habitat compared to much of the Harbor bottom. Conceivably, a greater diversity of bottom fauna may take up residence therein, compared to nearby muddy bottom areas. Additionally, as pointed out above, the sediment plume associated with dredging will occupy only a small portion of the width of the Harbor at any one time. This will allow for the passage of fish and will further limit negative biological effects. Filamentous algae colonizing bulkheads and piles in the Fort Point Channel and East Boston landfills will be displaced temporarily. Generally, within a year after construction of a particular structure is complete, recolonization will be underway.

The proposed project, including aspects of dredging and construction in the Boston Harbor area, have been discussed with the U.S. Fish and Wildlife Service during performance of this study. Their inputs were included in establishing data collection and testing/analysis requirements.

4.9 WETLANDS

No federally-regulated wetlands occur in the project area. Wetlands defined by State regulation collectively include all lands seaward of the 100-year flood line. Consequently, areas classified as state wetlands incorporate developed and other upland sites, intertidal zones, and such open water areas as Boston Inner Harbor and Fort Point Channel.

Such areas comprise various types of developed land use, water resources, floodplains, and upland vegetative communities. Accordingly, potential impacts resulting from the build alternatives are more appropriately addressed in those respective sections of this report (4.4, 4.8, 4.10, and 4.11).

Only the No-Build Alternative avoids impact to project area wetlands. Regardless of the build alternative selected, facility construction will result in the conversion of the South Bay area of Fort Point Channel from an open water community to an upland site. This area, extending from West Fourth Street to Dorchester Avenue, presently consists of approximately 9.5 acres of open water. The conversion of South Bay to an upland environment will effectively constitute a long-term impact, as well as a loss of open water wetlands as based on Massachusetts regulations.

Additional impacts to existing open water communities will occur in the remainder of Fort Point Channel. The construction of either alignment will result in the conversion of approximately 9.8 acres of open water to a developed site (relocated Dorchester Avenue) on top of the proposed tunnel. As with South Bay, this conversion constitutes a long term impact and an irretrievable loss of open water wetlands.

4.10 FLOODPLAINS

Each build alternative for the Third Harbor Tunnel involves placement of permanent structures in the waters of Boston Harbor, including Fort Point Channel. Hence, each has the potential for impact to flooding and floodplains. The Harbor has been modified by the construction of numerous bulkheads and consequently, the severity of such effects is limited. Only the No-Build Alternative will avoid impacts to flooding and floodplains.

4.10.1 Flooding

As stated in Section 3.8,

flooding in Boston Harbor is controlled almost entirely by a combination of the high tides and storm surges which accompany hurricanes and major winter storms. For this reason, the only impact that the Third Harbor Tunnel can have on flooding is through a reduction in the cross section of the Harbor and, hence, in its ability to pass flood waters. For the Harbor as a whole, this effect will be negligible, since none of the alternatives calls for any significant reduction in the cross section of the main channel.

The mean sea level water surface area of the Inner Harbor is approximately 54.5 million square feet (upstream of Pier 5, South Boston). Alternatives 2 and 3 will occupy approximately 830,000 square feet of the water plane in Fort Point Channel. Alternatives 4 and 5 will cover approximately 840,000 square feet in Fort Point Channel. In all four cases, the decrease in water plane area is less than 1.6 percent of the existing Harbor area, and results in a negligible (uncalculable) rise in floodwater elevation within the Inner Harbor.

Flooding impacts in Fort Point Channel are similarly small. The floodplain encroachment required for Alternatives 2 and 3 will reduce the width of the Channel at Northern Avenue from its present 560 feet to 450 feet. Alternatives 4 and 5 will reduce the Channel width to 460 feet. For a 100-year storm flow to pass through the reduced cross section and reduced length of the Channel (3,700 feet in all cases), calculations indicate that the elevation increase would be 0.001 feet in all cases.

While this represents a calculable increase over the elevation required under existing conditions, it is put into appropriate perspective by comparison to the effects of atmospheric pressure changes. One inch of barometric pressure will result in local sea level changes of up to one foot. The elevation difference here is one-thousandth of one foot. The reason for such an insignificant increase in elevation is that the displacement is spread over an extremely large area.

The reductions in floodplain area associated with all build alternatives for the Third Harbor Tunnel will have negligible effects on flooding both in Boston Harbor as a whole and in Fort Point Channel.

4.10.2 Floodplain Impacts

Floodplain Encroachment

Comparing the plans for the Third Harbor Tunnel Alternatives to the Floodplain Map contained in Section 3.8 (Figure 26), the areas of floodplain encroachment have been determined.

All four build alternatives require the filling of 9.5 acres of Fort Point Channel between West Fourth Street and Dorchester Avenue. Along the remainder of Fort Point Channel, Alternatives 2 and 3 will require the permanent occupation of 9.7 acres of floodplain and Alternatives 4 and 5 will require permanent occupation of 9.8 acres of floodplain. Across the Harbor, Alternatives 2 and 4 will require encroachment on 3.7 acres within the Conrail right-of-way in East Boston that are now within the floodplain. These areas are summarized below in Table 49. Again, the No-Build Alternative has no effect on floodplain encroachment.

Table 49

FLOODPLAIN ENCROACHMENT
(acres)

Location	Alternative 2	3	4	5
Fort Point Channel	19.2	19.2	19.3	19.3
East Boston	3.7	0.0	3.7	0.0
Total	22.9	19.2	23.0	19.3

The total amount of floodplain to be encroached upon by Alternatives

2 and 4 is slightly greater than the encroachment by Alternatives 3 and 5. The maximum encroachment, however, is 23.0 acres, less than two percent of the total floodplain of the Inner Harbor, which comprises over 1,400 acres.

Measures to Minimize Floodplain Impacts

The insignificance of the impacts on flooding and floodplains associated with the project and the limited natural and beneficial value of the floodplains encroached upon indicate that, other than normal care in design and construction, no measures to minimize impacts are warranted for any of the build alternatives.

Alternatives to the Floodplain Encroachment

The project alternatives will each encroach on some floodplain area.

The alignment options for the Third Harbor Tunnel are limited by severe location constraints due to the transportation goals of the project and the fundamental requirement to connect to the existing highway network in a way which meets these goals. They are further limited by constraints of high value commercial/industrial development both in Boston and East Boston. With the severe constraints on practical roadway alignments due to logical roadway terminal and urban development, floodplain encroachment is unavoidable; however, design refinements have minimized the extent of encroachment.

An option within the Fort Point Channel area which would have further minimized encroachment was evaluated. A lower elevation of the tunnel in the Fort Point Channel (as described in Section 2.7) would have substantially reduced the permanent encroachment. However, acceptable profiles for roadway connections would not be achieved, most notably with the Fort Point Channel split alignment (Alternatives 2 and 3), and the mainline connections to the Southeast Expressway on the south and Central Artery on the north, while also maintaining a ramp connection to Summer Street.

Encroachment within the Channel is minimized by the use of vertical granite-faced wall to be constructed parallel to the existing Channel wall and offset approximately 110 feet to the south. Within this 110-foot wide corridor, Dorchester Avenue will be relocated on the roof slab of the tunnel approach roadway.

On the East Boston side of the crossing, Alternatives 2 and 4 follow the railroad right-of-way which, because of its low elevation with respect to tides, has been designated as a floodplain area. Relocation of the project laterally in either direction to avoid disruption of this narrow strip of floodplain is not considered feasible due to the severe impacts on the East Boston community which would occur, including significant displacements of residences and businesses, and disruption of local roadway traffic circulation patterns.

4.11 VEGETATION AND WILDLIFE

4.11.1 Vegetation

Potential impacts to vegetation will be minimal, regardless of the alternative selected. In the vicinity of West Fourth Street and the Broadway Bridge, small portions of landscaped (City of Boston Maintenance Facility) and successional sites will be affected by tunnel ramps for all build alternatives. A loss of approximately 0.5 acres will be affected in this area.

Along the railroad alignment in East Boston (Alternatives 2 and 4), approximately 2.0 acres of successional land associated with the railroad right-of-way constitutes the only vegetative community to be affected. Due to the relatively low diversity of plant species and the

extent to which this area has been disturbed, vegetative impacts will be limited in extent.

The airport alignment (Alternatives 3 and 5) will displace 0.1 acres of landscaped land at Logan Airport and 0.1 acres of parkland at the East Boston Memorial Stadium. Temporary disturbance of 0.08 acres of parkland will also take place. The land will be restored after construction.

4.11.2 Wildlife

Impacts to wildlife will be very limited. As indicated in Section 3.9.2, the wildlife habitat potential of vegetative communities in the project area is minimized by their scattered location, relatively small size, proximity of densely developed sites, relatively low diversity of plant species, and the extent to which these areas have been disturbed. Consequently, the minimal and in some cases temporary loss of vegetation is not expected to affect existing wildlife populations in the overall project area significantly, regardless of the alternative selected. Effects on aquatic life have been evaluated previously in Section 4.8.

4.11.3 Endangered and Threatened Species

No endangered or threatened species listed at either the Federal or State levels are known to occur in the project area. Their future occurrence in these areas is also highly unlikely. Thus, no impacts to these species are anticipated.

4.12 DREDGED MATERIAL DISPOSAL

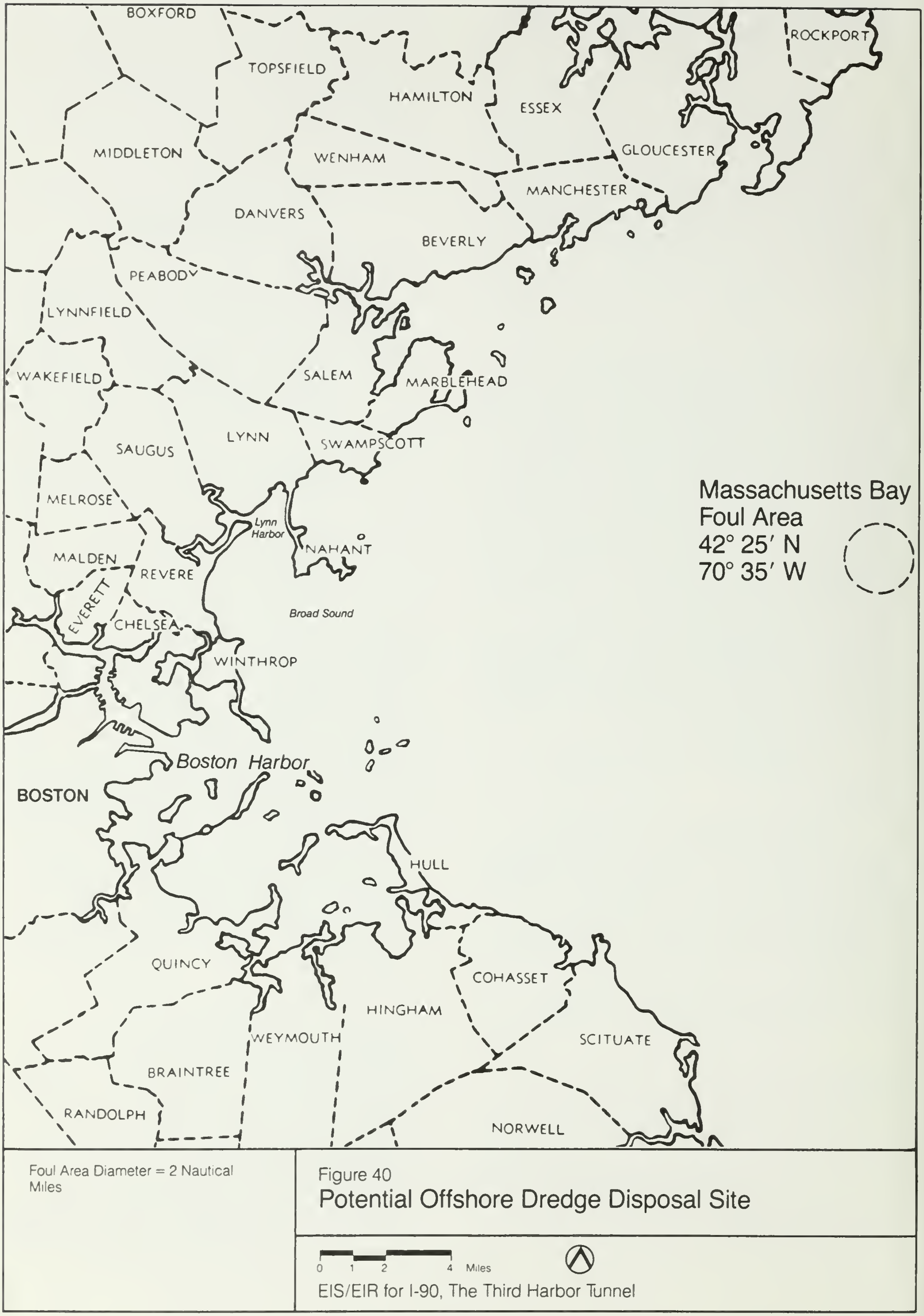
Tunnel construction in Boston Harbor and Fort Point Channel will require excavation of approximately 2.1 million cubic yards of marine sediment for the railroad alignment (Alternatives 2 and 4) and 2.7 million cubic yards of marine sediment for the Airport Alignment (Alternatives 3 and 5). A summary of volumes of marine sediments to be excavated is shown in Table 50.

The volume of surface organic muds constitutes approximately 9-10 percent of the total quantity of dredged material. Between build alternatives, there are minor differences of one percent in the overall total. These estimates of surface organic muds versus total dredged material are based on the results of the boring program conducted in April and May, 1982. Of the total amount of muds dredged, approximately one-half is highly contaminated, as discussed in Section 3.6. Section 4.1 discusses construction aspects of the project. Disruptions to navigation in the Harbor should be minimal during dredging, and will be coordinated with the US Coast Guard and others as appropriate.

Table 50
SUMMARY OF MARINE SEDIMENTS TO BE DREDGED
(cubic yards)

Location		Airport Alignment	Railroad Alignment
Harbor	0-3'	206,500	146,800
	3-55'	2,290,700	1,501,100
	Total	2,497,200	1,674,900
Channel	0-3'	47,000	64,300
	3-50'	192,700	322,700
	Total	239,700	387,000
Both	0-3'	253,500	211,100
	3'-bottom	2,483,400	1,850,800
	Total	2,736,900	2,061,900

The present plan for disposal of the marine sediments is to transport the materials to the Massachusetts Bay Foul Area. The Foul Area, shown on Figure 40, is a site approved by the EPA and Corps of Engineers for open water disposal of sediments dredged from Harbors, provided that the sediments pass a series of tests beginning with the bulk sediment analyses and ending with a series of bioassay analyses. The



Foul Area Diameter = 2 Nautical Miles

Figure 40
Potential Offshore Dredge Disposal Site

EIS/EIR for I-90, The Third Harbor Tunnel

Foul Area is two nautical miles in diameter and 300 feet deep. There is more than sufficient capacity for Third Harbor Tunnel sediments at the Foul Area. Alternative dredged material disposal sites are discussed below.

4.12.1 Bioassay Testing

Bioassay tests are generally required when a dredging project involves open water disposal.

There has been coordination with the U.S. Army Corps of Engineers (COE), the U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), the Massachusetts Office of Coastal Zone Management (MCZM), and the Massachusetts Division of Water Pollution Control (DWPC). Results of the bulk chemical analyses discussed in Section 3.6 were used throughout the consultations to determine the type of bioassay tests required and upon which sediments the analyses would be conducted. It was concluded that solid phase bioassay tests followed by bioaccumulation tests were necessary and the following sampling locations were selected (see also Figure 22).

Bioassay Site Number	Sediment Sample Location
1	FP-2, FP-3
2	SH-201, SH-205
3	FP-4, NH-203, SH-204
4	NH-201, NH-202, SH-202, SH-203

Since the Fort Point Channel from the end of the Roxbury Canal Conduit to Dorchester Avenue is to be filled under all build alternatives, sediment from FP-1 was not included in the bioassay tests.

The test organisms were the grass shrimp, quahog, and the clam worm. Detailed results of the bioassay testing are contained in Appendix 7.

The solid phase bioassay test is employed as a measure of toxicity of sediments to the common test species. After a period of adaptation, the organisms are placed in aquaria containing the test sediment, control sediment, and reference sediment. The response, conditions, and mortality, if any, are monitored over the 10 day exposure period. At the end of the solid phase test, the surviving organisms are transferred to clean aquaria, allowed to purge themselves, and macerated for chemical analysis. Cadmium, mercury, PCBs, DDT, and petroleum hydrocarbons are analyzed in this procedure.

A statistical analysis of clam worms, grass shrimp, and quahogs surviving the solid phase test indicated there was no significant difference between the survivors from the reference or dredge material tests. No consistent trend was detected between surviving species and sample sites. Other statistical testing, however, indicated significant differences in survival of the quahog between Sites 1 (Fort Point Channel) and Site 2 (near Jeffries Cove). See Table 51 for a summary of the bioassay test results.

Normal behavior of the clam worms and quahogs was observed as they established burrows and siphon holes in the test sediment. However, shrimp in the dredge material tests swam more than those in the control or reference samples and tended to keep the sediment continually suspended.

The accumulation of metals and organic compounds by any of the test organisms was not overall significantly different between any of the dredge material sites and the reference sediment south of the Foul Area. There was a slightly significant accumulation of mercury in the quahog in Fort Point Channel sediment and a slightly significant accumulation of DDT in the grass shrimp from Sites 3 and 4.

Based on the results of the bioassay and bioaccumulation tests,

Table 51

SUMMARY OF PERCENT OF ORGANISMS SURVIVING BIOASSAY TESTS

Organism	Control	Reference	Third Harbor Tunnel Bioassay			
			1	2	3	4
Clamworm						
Mean	92	88	68	76	83	81
Range	80-100	75-100	60-95	35-90	65-100	50-100
Quahog						
Mean	97	89	92	87	83	81
Range	90-100	80-95	80-100	75-100	75-90	70-90
Grass Shrimp						
Mean	91	82	80	92	86	88
Range	90-92	75-90	69-100	82-100	76-97	83-93

Data are based on results after 240 hours of exposure with 5 replicate tests per treatment.

the Third Harbor Tunnel sediments including those from the Fort Point Channel are not acutely toxic, do not lead to significant concentrations of contaminants in the flesh of the test organisms, and should be considered acceptable for disposal at the Massachusetts Bay Foul Area.

4.12.2 Alternative Dredged Material Disposal Sites

The disposal of sediments dredged for the Third Harbor Tunnel is similar in scale to the disposal of dredged material from the proposed COE navigation improvement for Boston Harbor, where approximately four million cubic yards of materials will be removed. COE had recently considered seven specific options and four general options for the disposal of that material. The specific options were:

(1) Massachusetts Bay Foul Area
(2) Fort Point Channel
(3) Lynn Harbor
(4) Squantum Point
(5) Boston Harbor Islands
(6) Boston Marine Industrial Park
(7) Logan Airport

General consideration was given to:

(1) Artificial Reefs
(2) Landfill Covering
(3) Quarry Reclamation
(4) Barrier Islands

Most of these options were determined to be unsuitable for the COE project and would likewise be unsuitable for the Third Harbor Tunnel project.

Specific options eliminated from consideration by COE were Fort Point Channel, Squantum Point, Boston Marine Industrial Park, and Logan Airport. Fort Point Channel was eliminated because its filling would conflict with planned and programmed improvements in the area, including the Third Harbor Tunnel project. Filling of shallow water areas at Squantum Point in Quincy was rejected because of the extensive and productive clam flats that would be destroyed. Massport, as part of its Boston Marine Industrial Park, is filling a substantial area, but require fill of good structural quality. Similarly, filling at Logan Airport appears impractical because of the poor engineering characteristics of much of the material to be removed.

None of the general options were found to offer significant potential for the COE requirements or those of the Third Harbor Tunnel. Artificial fishing reefs can only be created with rock, not with mud, clay, or till. Landfill covering could only be implemented with clean clays and would require substantial re-handling to isolate this material. No sponsor could be found for the reclamation of quarries, such as those at Quincy. Barrier island creation requires clean, sandy material which does not occur in the Third Harbor Tunnel project area.

The three remaining specific disposal options do offer potential for disposal of the materials from the Third Harbor Tunnel. The Massachusetts Bay Foul Area is suitable for the ocean disposal of dredged material.

The material from the Third Harbor Tunnel has been subjected to both bioassay and bioaccumulation analyses and found to be non-toxic and, therefore, should be acceptable for ocean disposal under current regulations. Ledge removed from the project area could be disposed at the Lynn Harbor site if timing were suitable.

Finally, ledge and clean material might be employed in restoration efforts on Spectacle Island in Boston Harbor. These last two alternatives will not meet the full requirements for disposal from the project but will be considered later as far as timing and volume allow.

4.13 HISTORICAL AND ARCHAEOLOGICAL IMPACTS

4.13.1 Historical Impacts

Impacts on historic resources identified in Section 3.10 are evaluated below. The impact criteria for historical resources have been recognized by the Advisory Council on Historic Preservation, which has responsibility for review under Section 106 of the National Historic Preservation Act. Direct impacts involve total or partial takings of a historic structure or site; indirect impacts involve loss of access to the resource, isolation of the resource (a term referring to the loss of or separation of the resource from the context which contributes to the historic significance of the resource), or adverse changes in the visual or acoustical environment which contribute to the historic value of the resource.

Section 106 review has been initiated and will be completed prior to the Final EIS. Formal determination of eligibility for the National Register of Historic places have not yet been made except where noted below. The determination of potential eligibility referred to below were made by concurrence of the State Historic Preservation Office (SHPO) and FHWA, as provided in current Federal regulations. A Memorandum of Agreement will be prepared, if necessary, prior to completion of the Final EIS.

East Boston

The historic resources previously identified are listed below.

1. Woodbury Building.
2. Streetcar Tunnel (MBTA Blue Line tunnel).
3. 8-16 Henry Street and 9-11 Paris Street.
4. 184-194 Sumner Street.
5. 12-24 Paris Street.
6. Our Saviour American Lutheran Church.
7. Jeffries Point potential National Register district.
8. Sumner Street Fire Station.
9. Immigrants' Home.
10. Butler Aviation Hangar.

Long-term Impacts. In East Boston, the historic resources identified will not be significantly affected in the long term by any of the build alternatives. The Butler Aviation Hangar (Resource No. 10) will be indirectly affected by Alternatives 3 and 5 due to removal of the neighboring General Aviation Building and much of its associated landscaping, and by introduction of a toll plaza and ventilation building adjacent to the Hangar. However, changes in the historic setting of this Hangar will occur due to implementation of Massport's Airport Master Plan, regardless of the Third Harbor Tunnel project, which will change the use of this area from aviation-related activities to car rental, air freight handling, and office uses. These changes will increase traffic on the Bird Island Flats access road which passes through a corner of the site, and will tend to isolate the property from the activities which contributed to its historic significance.

Construction Impacts. The construction activities of Alternatives 2 and 4 will visually separate resources 1-9 from their historic context due to the presence of construction equipment and materials, and due to the noise and dirt associated with the construction, but these impacts will be short term. If vacant lands behind the Massport piers are used as a construction staging area, noise and dirt effects on the Immigrants Home on Marginal Street would be increased. Physical

damages to these resources, such as from construction vibration and settlement, will not occur.

Alternatives 3 and 5 will have no short-term construction impacts on those resources, but will affect the Butler Aviation Hangar (resource 10) due to the construction activities. Because of the ongoing construction in the area (by Massport), and the effects on this site which will occur from implementation of the Airport Master Plan, these short-term impacts are not significant.

Mitigating Measures. Construction staging plans will be developed similar to those described in Section 4.1 which control the Contractor's operations in the area, particularly as they relate to construction equipment usage of local streets, working hours, etc. Storage of construction equipment and materials in areas removed from these historic resources will be required to the extent possible, to minimize the short-term isolation of these resources from their surroundings.

Boston

The historic resources affected by the project on the Boston side of the Harbor are listed below.

11. Fort Point Channel potential National Register District.
12. Russia Wharf Buildings.
13. Custom House National Register District.
14. South Station Headhouse.
15. Boston Leather District.
16. The South End National Register District.
17. Albany Street Industrial Area.

Long-Term Impacts. There will be impacts on historic resources in the Fort Point Channel area. With Alternatives 2 and 3, the western bulkhead line of Fort Point Channel will be moved approximately 100 to 115 feet towards the east into the existing Channel, reducing the Channel's width by approximately 20 to 40 percent depending on location. The proposed ventilation buildings will visually affect the area. Relocated Dorchester Avenue will separate a number of buildings and parcels (including resource number 12) from their direct water access. This roadway will introduce vehicular traffic along the Channel where historically traffic has only moved across it. The new viaduct ramp at Summer Street will also affect the visual character of the Channel and historic Boston Wharf Co. buildings on the South Boston side of the District. Removal of the western spans of the Congress and Summer Street Bridges will be required for construction of relocated Dorchester Avenue, shortening the bridges and affecting their symmetry and visual character. The lift span and counterweight of the Congress Street Bridge will remain intact, although the diagonal trusses which carry the movable spans of the Summer Street Bridge will be removed. The Old Colony Railroad Bridge will also be removed during construction and the Channel will be filled as far as the West Fourth Street Bridge to accommodate the interchange connections.

With Alternatives 4 and 5, long-term historic impacts on the Fort Point Channel will be similar to Alternatives 2 and 3, although two viaduct ramps at Summer Street will more adversely affect the visual character of the Channel.

All build alternatives will separate the Russia Wharf Buildings (resource 12) from their direct water access. The Custom House District (resource 13) will be positively affected by removal of the present High Street off-ramp from the Central Artery, and resulting traffic reductions on the District's streets, with Alternatives 2 and 3; Alternatives 4 and 5 will have no

effect on the district.

South Station (resource 14) will be significantly affected by the ongoing transportation project discussed previously; the build alternatives will have no direct effect on this resource. All build alternatives result in slight traffic reductions on streets within the Boston Leather District (resource 15), and no significant effects are expected to the South End National Register District (resource 16) or the Albany Street Industrial Area (resource 17) from any alternative.

Construction impacts. During construction, all build alternatives will alter both the vehicular and water access to the Fort Point Channel area as a result of successive closing or reduction in width of the bridges, the placement of steel sheeting in the Channel, and the presence of barges and construction equipment. The construction activities themselves may also affect the area and its use as a result of construction-related noise, dust, etc. In particular, activities at the Boston Tea Party Ship Museum will be adversely affected due to the construction effects, since their activities include on-deck presentations of the historic Tea Party.

The build alternatives will also create short-term noise, dirt, and vibration impacts on the recently rehabilitated Russia Wharf Buildings. Traffic will detour through the Custom House National Register District to avoid congestion on Purchase Street, Atlantic Avenue, and the Central Artery (Dewey Square Tunnel area) during construction of Alternatives 2 and 3 (no effect during construction of Alternatives 4 and 5). Increased noise levels and associated construction effects will be experienced in the Albany Street Industrial Area during construction of Alternatives 4 and 5, but the impact will be minimal owing to the industrial nature of the District.

Mitigating measures. Construction period impacts to the Fort Point Channel, Russia Wharf Buildings, the Custom House National Register District, and East Boston properties can be mitigated to some extent by specifications which require: (1) construction methods and equipment that minimize noise and vibration; (2) controls on dirt (e.g., limitations on stockpile locations and covering); and (3) limitations on construction-related traffic.

Mitigating measures for long-term impacts to the Fort Point Channel District are described in Chapter 5.0. They include replacement of the Old Colony Bridge truss and railbed at-grade; photo documentation of the existing bridges; simulation of the Fort Point Channel bulkhead by use of granite facing on the relocated bulkhead; and design of the Summer Street ramps to reduce visual intrusion into the Channel.

These measures will be reviewed during the Section 106 process. The potential for mitigation of the project impacts is limited because relocated Dorchester Avenue and the Summer Street ramps are essential features of the project (see Section 2.7).

4.13.2 Archaeological Impacts

Combined hand testing and backhoe trenching in several areas of the proposed right-of-way for the build alternatives is proposed for the purpose of locating both historic and prehistoric archaeological resources. Several of the potential sites expected to be in the project area have been located through historic documentation, and testing should be conducted specifically for those sites. Other expected resources are not likely to be located through historic documentation (such as prehistoric sites or early trade sites) and, therefore, must be searched for while testing for sites of known probable location.

A Phase II survey, described below, will be performed prior to the

Final EIS to determine the boundaries of archaeological sites within the project right-of-way and to provide information on the National Register eligibility of these sites. Impacts and mitigating measures will be determined following this determination and a Memorandum of Agreement will be completed if necessary.

Hand testing is recommended in the Fort Hill area to locate residential and institutional remains (Alternatives 2 and 3); waterfront commercial and industrial remains are expected to be found through backhoe and hand trenching in the South Cove area (all build alternatives).

For Alternatives 2 and 4 in East Boston, backhoe trenching is recommended in the waterfront area in the vicinity of Pier 1 and between the waterfront area and Gove Street to locate remains of residential and mixed commercial/industrial activities that are believed to be preserved there. No excavations are necessary for the airport alignments in East Boston (Alternatives 3 and 5).

The exact scope of subsurface excavations will be determined through consultation with the State Archaeologist.

4.14 UTILITIES

Section 3.11 identified the extensive system of public and private utilities within the project area which will be affected by the various build alternatives of the Third Harbor Tunnel project. These utilities, which include water, storm drains, sanitary sewers, combined sewers, gas, electric, communications, etc., will be either temporarily supported or permanently relocated as part of the proposed project; utility services are not expected to be interrupted as a result of the construction of any build alternative. More detailed descriptions of these utility relocations are contained in the Supportive Engineering Report.

The following is a description of the major utilities requiring relocations by the various alternatives:

4.14.1 No-Build Alternative

This alternative proposes no project construction and therefore does not affect any existing or future utilities.

4.14.2 Alternative 2

Boston

- 72-inch combined sewer from Purchase Street to Oliver Street which crosses the Central Artery and discharges into the Fort Point Channel near Hook's Lobster Co.
- 36-inch x 36-inch combined sewer outfall at Congress Street and Dorchester Avenue extended.
- 60-inch combined sewer outfall at Summer Street and Dorchester Avenue.
- 81-inch x 81-inch combined sewer outfall in Dorchester Avenue (from Kneeland Street).
- 60-inch combined sewer outfall on the easterly side of the Fort Point Channel at the Dorchester Avenue bridge.
- Force mains of 36-inch and an 8-inch diameters from Massachusetts Turnpike Authority Pump House No. 7 in the South Bay.
- Twin chamber (20-foot x 15.5-foot each) Roxbury Canal Conduit outfall into the Fort Point Channel.
- Existing utilities within the Boston Edison utility tunnel crossing the Fort Point Channel between Congress Street and Summer Street.
- Telephone ducts within a telephone submarine cable between Congress Street and Summer Street under the Fort Point Channel from Dorchester Avenue and Sleeper Street

in South Boston.

o 16-inch and 24-inch water mains crossing Fort Point Channel from Dorchester Avenue at Congress Street to Northern Avenue in South Boston.

o 115,000 volt electric lines from Harrison Avenue, suspended on Broadway Bridge, crossing to South Boston at Dorchester Avenue.

o 115,000 volt electric lines from Boston Edison sub-station, crossing Fort Point Channel to South Boston near Northern Avenue.

o 120-inch x 36-inch combined sewer outfall proposed by others in South Bay at Albany Street near Traveler Street.

o 115,000 volt electric lines at Purchase Street and Oliver Street crossing Central Artery to Boston Edison sub-station near Harbor Plaza Building.

o 30-inch intermediate pressure gas pipe crossing in the area of the Turnpike ramps and the railroad yard from Kneeland Street to Albany Street.

o 32-inch x 54-inch East Side Interceptor combined sewer located in the vicinity of the railroad yards and crossing under the Turnpike Ramps.

o 32-inch x 54-inch East Side Interceptor combined sewer in Atlantic Avenue.

o 72-inch Gillette Company intake pipe in the Fort Point Channel in South Boston (also discussed under Water Resources - Industrial Water Users.).

o Telephone ducts in South Bay.

o 20-inch force main, proposed by others crossing Albany Street at Broadway and running parallel to the north side of the Broadway Bridge to an outfall in South Bay.

o MBTA pump house and tidal drain reservoir in the railroad yard adjacent to Broadway is to be abandoned by others.

East Boston

o 6-foot x 6-foot 4-inch combined sewer in Porter Street.

o 18-inch sanitary sewer in Gove Street.

o 2-foot x 2-foot 6-inch sewer in Maverick Street.

o 16-inch water main, 20-inch water main, 24-inch water main, 12-inch gas line, and a 36-inch drain crossing Airport access and egress roadways and East Boston Expressway (36-inch drain) near MBTA Airport Station.

o 24-inch sanitary sewer, crossing under two proposed ramps to the west of the MBTA Airport Station.

o 15-foot x 8.5-foot x 950-foot long underground storm drainage storage basin located between the MBTA Airport Station and the Scolly Air Freight Building.

o 6-foot 6-inch x 4-foot 4-inch drain from the existing drainage storage basin at the Airport above.

4.14.3 Alternative 3

Boston

Due to the similarity between Alternative 3 and Alternative 2 on the Boston side of the Harbor, utility impacts and relocations will be similar to those discussed in Section 4.14.2 for this area.

East Boston - Airport Property

o 60-inch storm drain located in the vicinity of the General Aviation Building.

o 8-inch sanitary force main located along the easterly side of the General Aviation Building.

o 42-inch outfall located in the

existing access road to Bird Island Flats.

o 10-inch fuel line in the vicinity of the Porter Street outfall.

o 300-foot section of the existing 10-foot x 12-foot Porter Street combined sewer outfall.

o 12-inch water main near the southerly end of the Eastern Air Freight Building.

o 15-inch sanitary sewer on Airport property.

o 18-inch sanitary sewer in the vicinity of the Hilton Hotel.

o Major telephone line and 20-inch water main to the west of the Hertz Check-In Center; a 60-inch drain, and telephone and electric ducts to the east of the Hertz Center.

o In the vicinity of the Exxon Station: major telephone line, 20-inch water main and 24-inch sanitary sewer.

East Boston

o 6-foot 6-inch x 4-foot 4-inch drain and a 24-inch sanitary sewer in the vicinity of the MBTA Airport Station.

o 12-inch gas line and a 20-inch water line in the vicinity of the MBTA sub-station.

o 12-inch gas line in the vicinity of the access road to the East Boston Athletic Field.

o 7-foot 10-inch x 8-foot 2-inch storm drain in the vicinity of East Boston Athletic Field.

4.14.4 Alternative 4

Boston

o Massachusetts Turnpike Authority (MTA) Pump House No. 7.

o 36-inch and 60-inch storm drain from the Massachusetts Turnpike ramps near Kneeland Street to MTA Pump House No. 7.

o MBTA pump house and tidal drain reservoir in the railroad yard adjacent to Broadway will be abandoned by others.

o Telephone ducts in the South Bay area.

The following utilities will be affected and relocated basically in the same manner as for Alternative 2:

o 115,000 volt electric lines from Boston Edison sub-station, crossing Fort Point Channel to South Boston near Northern Avenue.

o 120-inch x 36-inch combined sewer outfall in South Bay at Albany Street near Traveler Street.

o Roxbury Canal Conduit outfall (twin 20-foot x 15.5-foot chambers) at West Fourth Street.

o 30-inch intermediate pressure gas pipe crossing the area of the Turnpike ramps and the railroad yard, from Kneeland Street to Albany Street.

o 16-inch and 24-inch water mains crossing Fort Point Channel from Dorchester Avenue at Congress Street to Northern Avenue and to South Boston.

o Boston Edison utility tunnel crossing Fort Point Channel between Congress Street and Summer Street.

o Telephone submarine cable between Congress Street and Summer Street crossing Fort Point Channel from Dorchester Avenue and Sleeper Street in South Boston.

o Gillette Company 72-inch intake pipe in Fort Point Channel on the South Boston side. (See also Water Resources.)

o 20-inch force main proposed by

others, crossing Albany Street at Broadway and running parallel to the north side of the Broadway bridge to an outfall in South Bay.

- East Side Interceptor proposed by others in the vicinity of the railroad yards and crossing under the Turnpike ramps (32-inch x 54-inch combined sewer).

- 115,000 volt electric lines from Harrison Avenue suspended on the Broadway Bridge crossing to South Boston at Dorchester Avenue.

- 60-inch combined sewer outfall to Fort Point Channel at Dorchester Avenue Bridge.

- Outfalls to South Bay (36-inch and 8-inch) force mains from MTA Pump House #7.

East Boston

Relocated utilities for Alternative 4 in this area will be the same as those discussed for Alternative 2 in East Boston due to the similarity of the alignments in this area.

4.14.5 Alternative 5

Boston

Utilities relocated for Alternative 5 in this area are the same as those listed for Alternative 4, due to the similarity of the alternative alignments in this area.

East Boston

Utilities relocated for Alternative 5 in this area are the same as those listed for Alternative 3, due to the similarity of the alternative alignments in this area.

4.15 VISUAL IMPACTS

4.15.1 Assessment Criteria

An individual's enjoyment and aesthetic appreciation of an environment is a result of sensory perceptions due to movement through an area, as well as mental associations of the area. Over time, these experiences are combined into an aesthetic image of each area. Visual impacts are assessed in three categories: 1) View from the Road, 2) View of the Road, and 3) Pedestrian Environment, and by alternative for each of the four distinct visual corridors identified in Section 3.13: South Bay, Fort Point Channel, East Boston Railroad Right-of-Way, and Jeffries Cove. Project mitigating measures eligible under current Interstate funding are referred to as Option 1. Additional potential project enhancement features, such as engineering and urban design measures, landscaping, and other amenities, are referred to as Option 2. These measures are described in Section 4.15.7.

4.15.2 No-Build Alternative

There are no visual impacts of the No-Build Alternative.

4.15.3 Alternative 2

South Bay

Today, as drivers enter the City on the Southeast Expressway and the Massachusetts Turnpike, they pass through an area which includes tidal flats, a granite bulkhead, old piers, and a historic railroad bridge spanning Fort Point Channel. These surviving elements from the active commercial and shipping era of the Channel's history are a visual entry point to the City and to many are the first impression of Boston's character as a port city.

View from the Road. Alternative 2 will replace the open water in this area with a landscaped space covering the ramps connecting the Central Artery and Massachusetts Turnpike to the new tunnel. The ventilation building will be a

visually prominent object in this area. It will be on a direct sight line for drivers entering Boston on the Southeast Expressway, Massachusetts Turnpike, and from existing Dorchester Avenue as it approaches new Dorchester Avenue from South Boston. Its size and location will make it a new visual landmark at the city's principal highway entrances from the south and west (see Figure 41).

View of the Road. In the South Bay corridor, all tunnel ramps are located below grade, and the only visually prominent facility will be the new ventilation building mentioned above. The project will result in improved visual quality by removal of the present physical and visual clutter in the area associated with remnants of pier and railroad structures and stockpiled fill.

Pedestrian Environment. Today, pedestrian circulation is difficult owing to the maze of rapid transit, railroad, and highway rights-of-way. Pedestrian orientation and access through this area will be improved by removal of these physical obstructions. The proposed sidewalk along relocated Dorchester Avenue will provide easy access into downtown for South Boston residents.

Fort Point Channel

This area is a unique visual resource on the Boston waterfront; many public and private investments are underway or planned to capitalize on its assets. Most of the Boston waterfront is characterized by finger piers extending from the mainland into the Harbor. By contrast, the Fort Point Channel is an inlet, with building facades generally defining its eastern and western edges. The north side of the Channel opens out to views of harbor activities and the skyline beyond (see Figure 42).

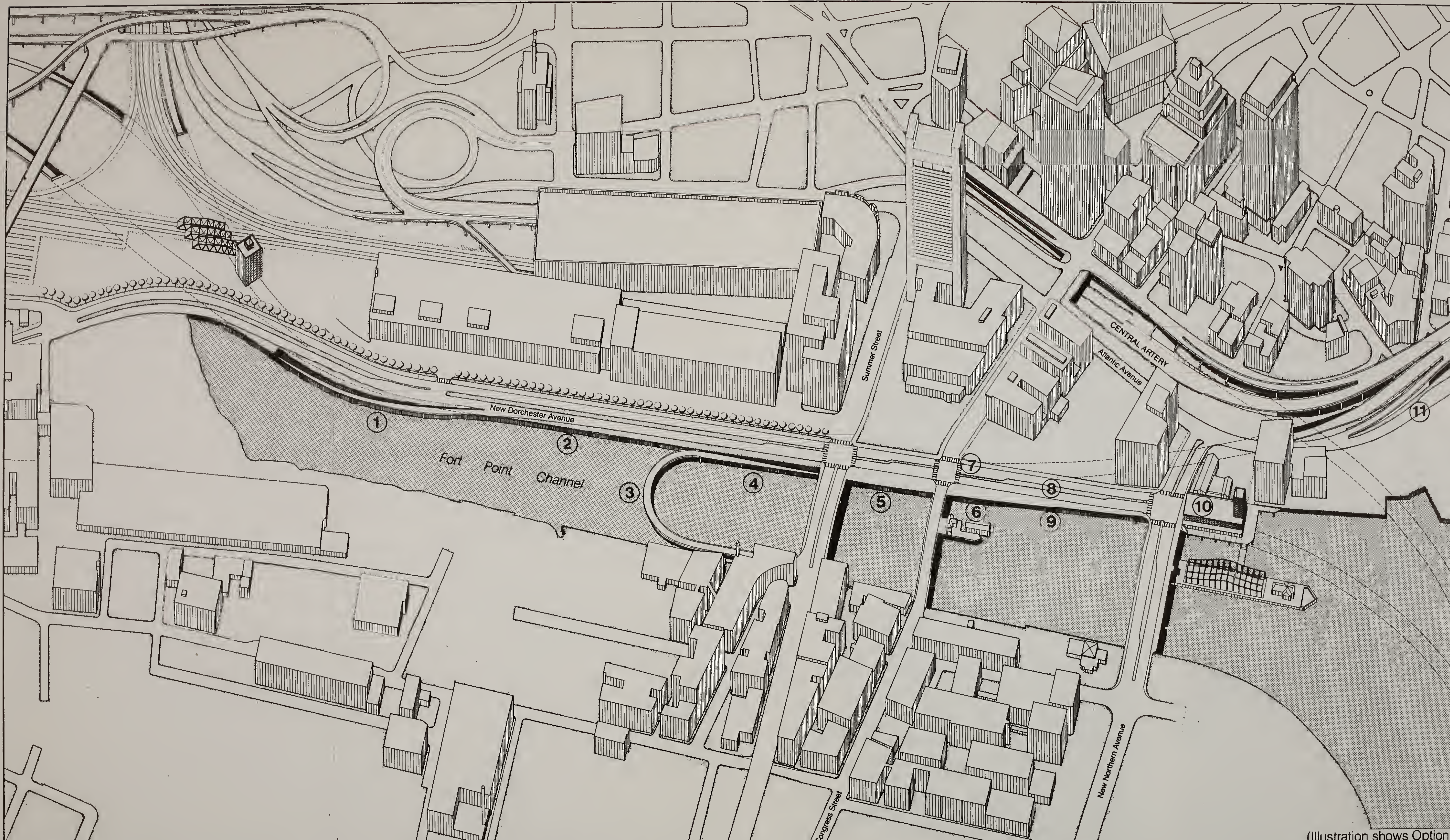
View from the Road. The motorist entering Boston on relocated Dorchester Avenue will enjoy dramatic views of the water and skyline. This view will include the ventilation building adjacent to the new Northern Avenue Bridge. The building will be designed with the base housing the fans and other mechanical equipment approximately 35 feet above the mean high water line. The ventilation stack would rise from the top of the building to a height of approximately 110 feet.

View of the Road. A new four-lane surface roadway, highway ramps, and a new ventilation building in the Fort Point Channel will affect the Channel's visual character and its contrasts with the density and activity of downtown.

The project will alter the appearance of existing roadways and bridges. For example, the Congress Street Bridge, a visual landmark spanning the Channel, depends upon the symmetry of its span, sculptural stone pillars, railings and lighting. As the tunnel and relocated Dorchester Avenue will remove the westernmost quarter of the bridge, four stone pillars and their decorative cast-iron lighting fixtures, the symmetry of the bridge will be affected (see Figure 43).

Several significant vistas will be affected by this alternative. The sight line down Broad Street from the Custom House National Register Historic District to the harbor will be blocked by a ramp connecting the Tunnel with the northbound Central Artery. The vista from the Boston edge of the Channel between Summer and Congress Streets north toward the harbor will be narrowed by the ventilation building. Looking back from the future Long Wharf Park site and the waterfront esplanade, partial views of the Tea Party Ship will also be blocked.

The ventilation building will be similar in height to the adjoining U.S. Customs Building and Harbor Plaza



Legend

1. Existing bulkhead line altered.
2. Tunnel projects 106 feet from the existing bulkhead line into the Channel, reducing its width by 23 percent.
3. Overhead ramp affects views from adjacent parcels.
4. Tunnel and northbound access ramp project a total of 180 feet from the existing bulkheads into the Channel, reducing its visible width by 40 percent.
5. Tunnel projects 140 feet from the existing bulkhead line into the Channel, reducing its width by 28 percent.
6. Symmetry of existing bridges is altered.
7. New pedestrian way provided; pedestrian access controlled by signalized intersections.
8. Introduction of traffic parallel to the Channel affects the area's character.
9. Tunnel projects 120 feet from the existing bulkhead line into the Channel, reducing its width by 20 percent.
10. Placement of ventilation building in the Channel affects views and alters the building line.
11. Pedestrian crossing relocated to the north.

(Axonometric Drawing)

Figure 41
Alternatives 2 & 3 Summary of Aesthetic Impacts

0 350 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

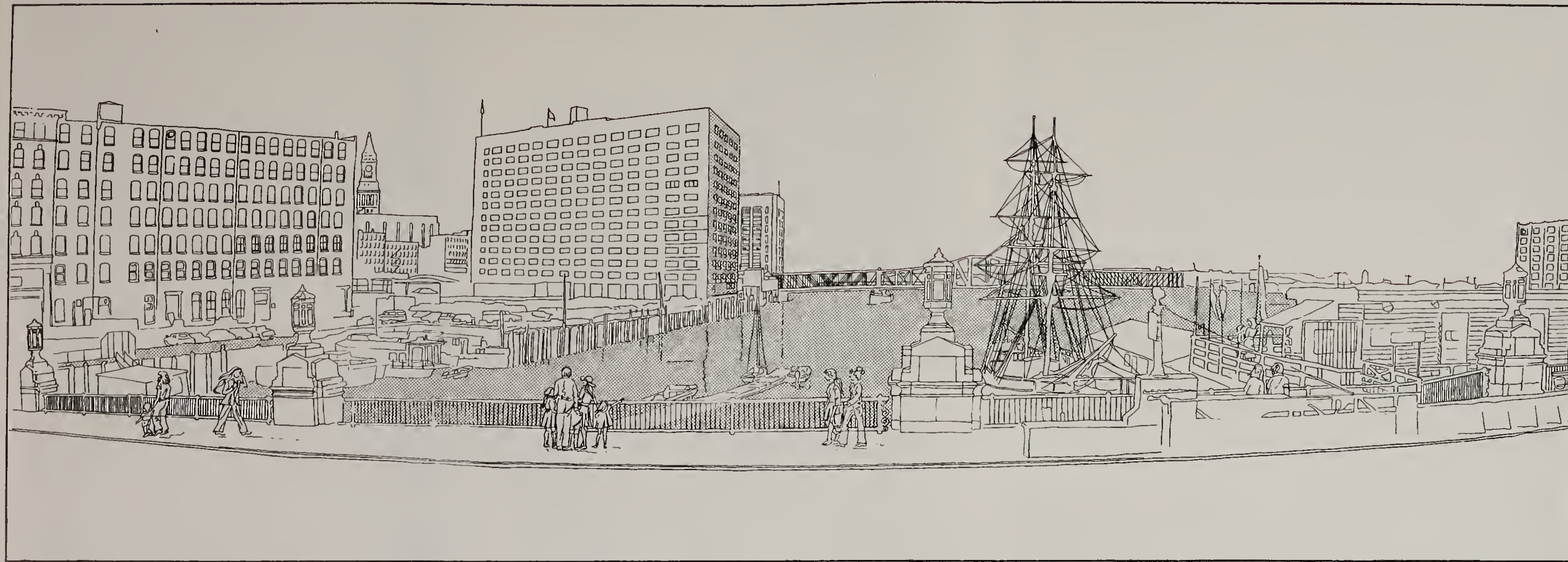


Figure 42
Existing View from Congress Street Bridge North Toward the Harbor

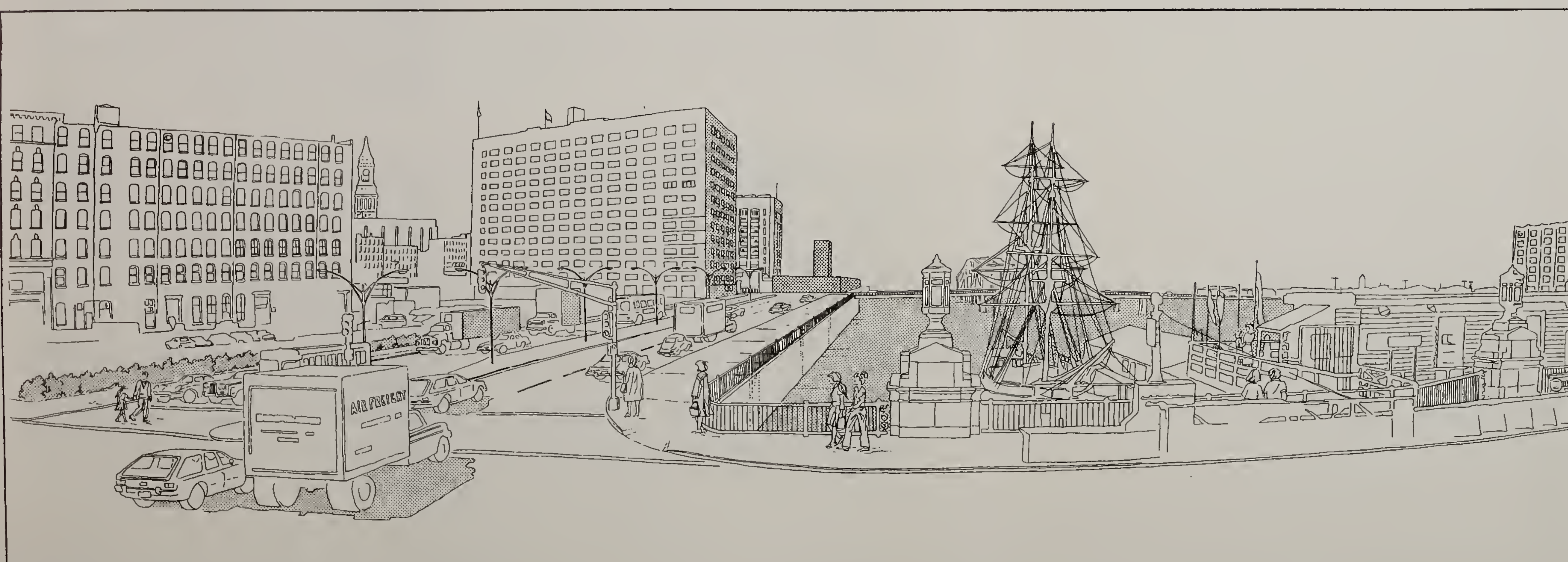


Figure 43
Alternatives 2, 3, 4 & 5, Option 1
View from Congress Street Bridge North Toward the Harbor

office building, although the architectural appearance of the building may differ.

The Channel is defined by its regular granite bulkhead and wooden wharf line and by a fairly regular wall of individual building facades behind the bulkhead. The visual identity of the Fort Point Channel is due in great part to these walls. Placement of the ventilation building will alter the regular building line on this side of the Channel. The Summer Street ramp and varying bulkhead line south of the Summer Street Bridge will be new features of the Channel's visual character.

Relocating the western bulkhead line approximately 120 feet to the east, and construction of the tunnel and its connecting ramps will reduce the width of the Channel's open water surface. The reduction in visible width will be 20 percent near the new Northern Avenue Bridge, 25 percent at Congress Street, 40 percent immediately south of Summer Street, and 28 percent south of the new ramp (visible water reduction results not only from the tunnel structure, but also from the ramp). The visual effect of this reduction varies depending upon the vantage of the viewer, but the visual character of the Channel is diminished by reduction of its principal amenity (see Figure 41).

Pedestrian Environment. Private developers and public agencies are acting to take advantage of the Channel's ambience, and the City of Boston has developed policies designed to extend a waterfront pedestrian esplanade around the water's edge. Pedestrian activity in the Fort Point Channel is expected to increase as planned expansion of existing walkways, marinas, and other water-related recreation improvements take place. Tourists and residents walk across the bridges and along the waterfront to enjoy the Channel's visual and historic character, and are drawn by its contrast with the noise and density of downtown Boston. The quality of the aesthetic experience in the Channel varies as a pedestrian moves across its bridges and along its edges. For example, as a person approaches the Congress Street Bridge from downtown today, the Fort Point Channel and the Tea Party Ship come into view before reaching the Bridge. In Alternative 2, a four-lane relocated Dorchester Avenue with signalized intersections will be introduced, moving the first sight of the water approximately 200 feet toward the Channel.

Today a person walking along Museum Wharf sees the reflection of buildings in the water across the Channel; at night, lights from adjacent buildings and the illuminated Boston skyline reflect in the water and create a positive aesthetic experience. With Alternative 2, views of the skyline will remain, but the movement, lights and sounds of cars and trucks on relocated Dorchester Avenue will dominate the environment and change the pedestrian's aesthetic experience.

Introduction of highway facilities into the Channel, alterations to the existing bridges and bulkheads and wharves, and narrowing of the water surface will affect the experience of walking through this environment.

In the Central Artery/Atlantic Avenue area, the pedestrian overpass at Oliver Street will be replaced, and the pedestrianway under the Central Artery at High Street will be shifted. Presently, it is possible to walk between downtown and the Rowe's/Foster's Wharf waterfront area by crossing under the Central Artery at the foot of High Street. In Alternative 2, pedestrians will cross opposite to Northern Avenue by walking approximately 400 feet further to the south or opposite East India Row approximately 300 feet further to the north.

There is currently no pedestrian access along privately-owned Dorchester Avenue. The project will provide a sidewalk along the full length of new Dorchester Avenue, thus providing a pedestrian connection between South Boston and downtown.

East Boston Railroad Right-of-Way

This corridor varies in width, topography and type of activity. Although the right-of-way physically separates the Jeffries Point and Central/Maverick neighborhoods, there is visual continuity between the two sides, and pedestrian crossings occur approximately every 500 feet (see Figures 44 and 47).

View from the Road. A motorist entering the toll plaza from the tunnel will glimpse only the upper floors and roofs of buildings in East Boston. The driver's attention will be directed to the directional signs for the two exit ramps to Route 1A and the airport roadway. At the merge with the airport roadway, motorists will be facing the airport control tower, a recognizable landmark for orientation.

View of the Road. The open toll plaza, ventilation building, Massachusetts Turnpike Authority (MTA) administration building and parking, and the relocated railroad track, will cover 50-58 percent of the existing railroad corridor within the project area (see Figure 46).

The toll plaza and railroad cut will be screened from view at ground level on Bremen Street by a wall running along each block between Porter and Marginal Streets. It will be screened from Orleans Street by a wall between Porter and Gove Streets. These walls screen the residential neighborhood from the visual impact of the toll plaza, but will be visual barriers between the two neighborhoods, and may contrast with the materials and texture of the windows, doors, and cornices of Bremen Street's three-story attached row houses which face it. On Orleans Street, there are no residences opposite the toll plaza.

The upper two floors of the residential buildings between Porter and Sumner Streets will overlook traffic in the toll plaza. Lighting facilities at the toll plaza will be designed to protect the residential character of Bremen Street.

South of Gove Street, existing views of the Boston skyline will be altered by introduction of the ventilation building, which will be located approximately 100 feet from the Harbor's edge. It could be divided into two sections: the base building would include the fan housing and mechanical room and would be approximately 35 feet above grade; the ventilation stack would rise from this base building to a height of approximately 100 feet above grade. The building will be visible from Bremen, Orleans, and Maverick Streets and for some residences on the hill in Jeffries Point (see Figure 45). Its location at the water's edge will make it visually prominent from the Boston Harbor and waterfront.

Pedestrian Environment. Today, the Gove Street pedestrian crossing of the railroad tracks is bordered by overgrown vegetation. In Alternative 2, the at-grade crossing will be replaced by a pedestrian bridge at the toll. A pedestrian will no longer have a clear view across the railroad cut in the vicinity of the pedestrian overpass (see Figure 48).

The masonry wall surfaces of the ventilation building may differ visually with many of the land uses recently proposed by developers, the four development concepts being considered by the East Boston Piers Project Area Committee, and with the longstanding City of Boston policy to provide an attractive pedestrian walkway along this section of the East

Figure 44
Cut Away of Existing View Looking from the Maverick Street Bridge South Toward the Harbor

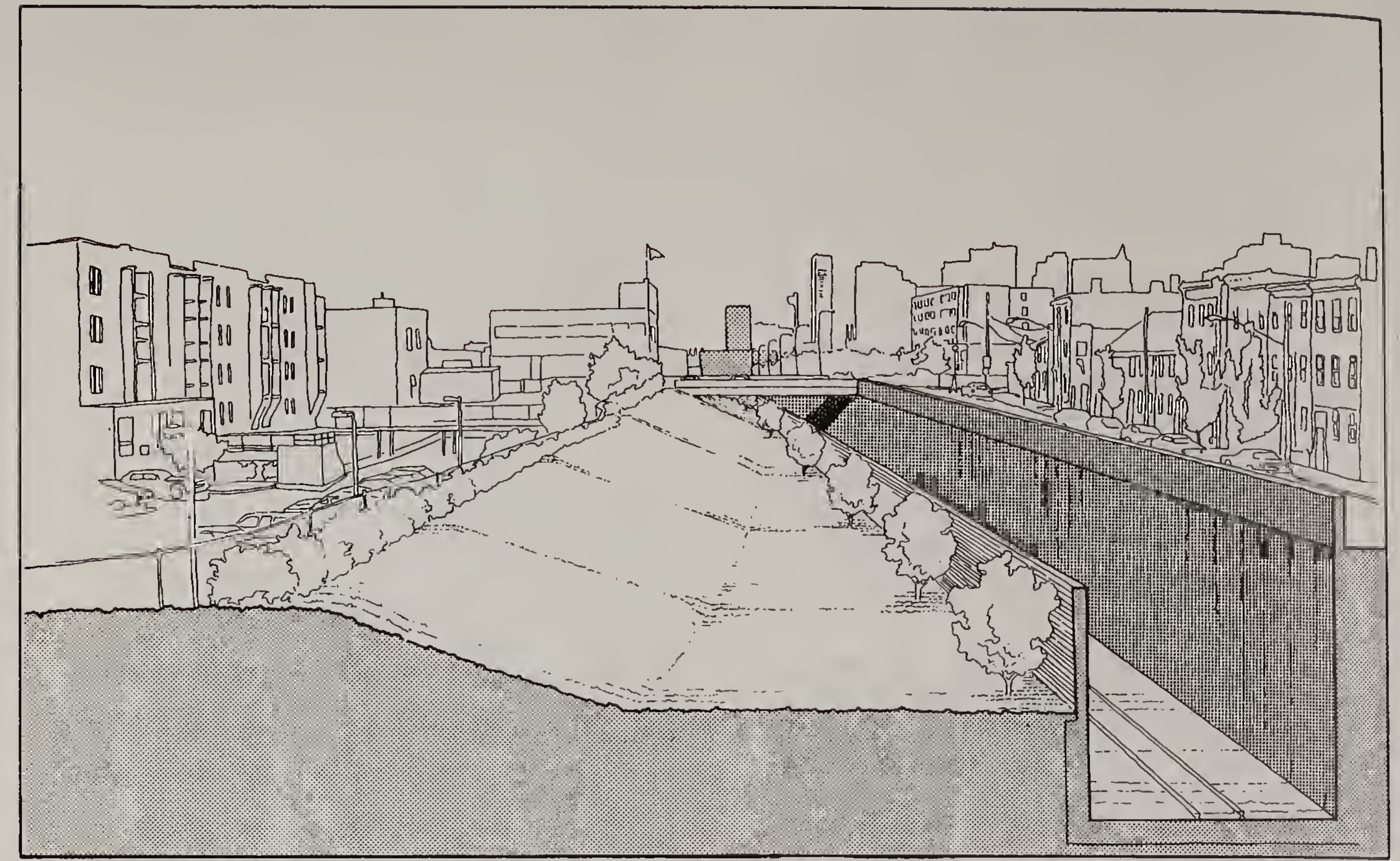


Figure 45
Alternatives 2 & 4, Option 1
Cut Away View Looking from the Maverick Street Bridge South Toward the Harbor

Legend

1. Ventilation building and stack; Options 1 and 2.
2. Open railroad right-of-way; Option 1.
3. Parcels available for community re-use, no access from Bremen Street; Option 1.
4. Wall parallel to Bremen Street affects view between neighborhoods; Option 1.
5. Project elements occupy approximately 58 percent of the corridor, 42 percent available for community use; Option 1.
6. Open toll plaza visible from upper floors of homes; Option 1. Open area reduced by half in Option 2.

(Axonometric Drawing)

Figure 46
Alternatives 2 & 4
Summary of Aesthetic Impacts

0 350 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

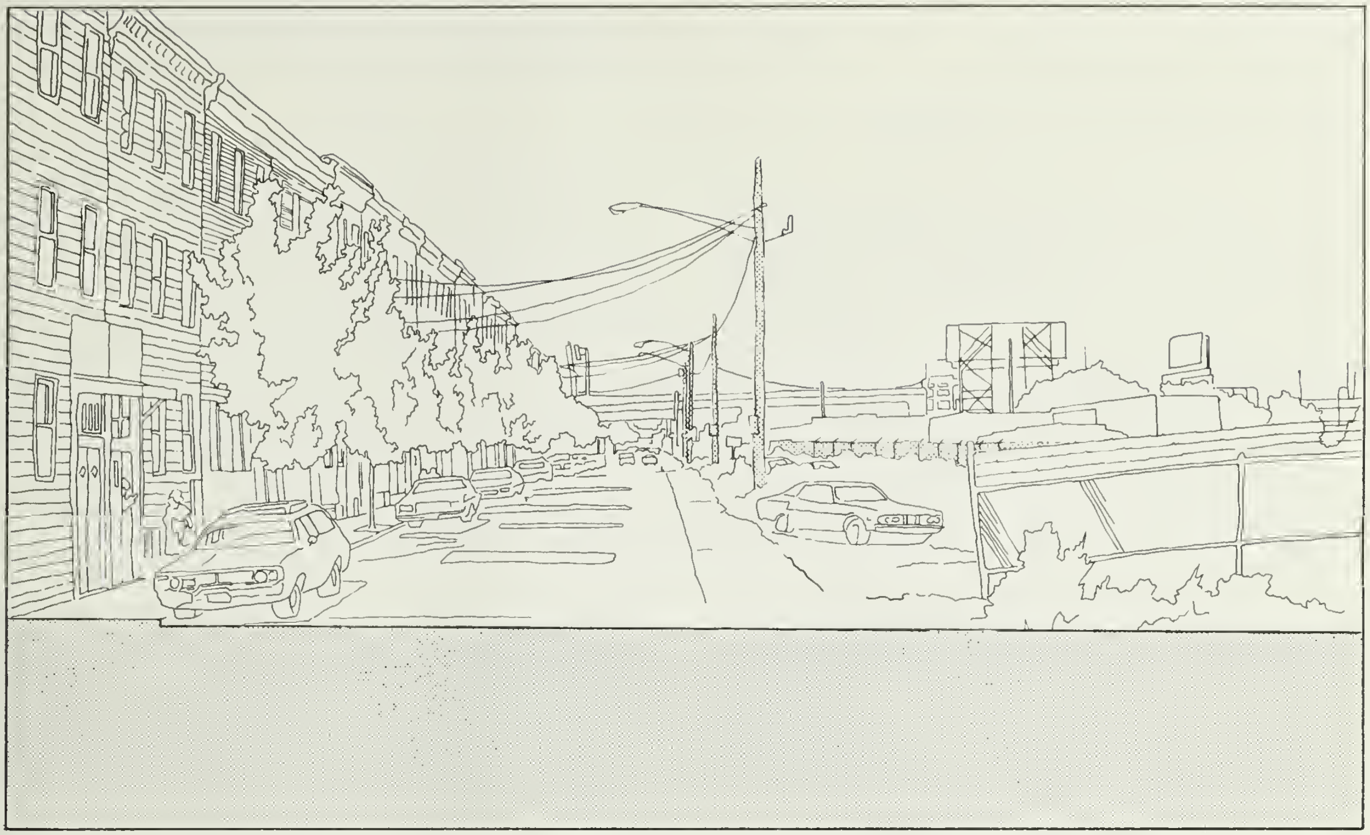


Figure 47

Cut Away of Existing View Looking North on Bremen Street from Gove Street

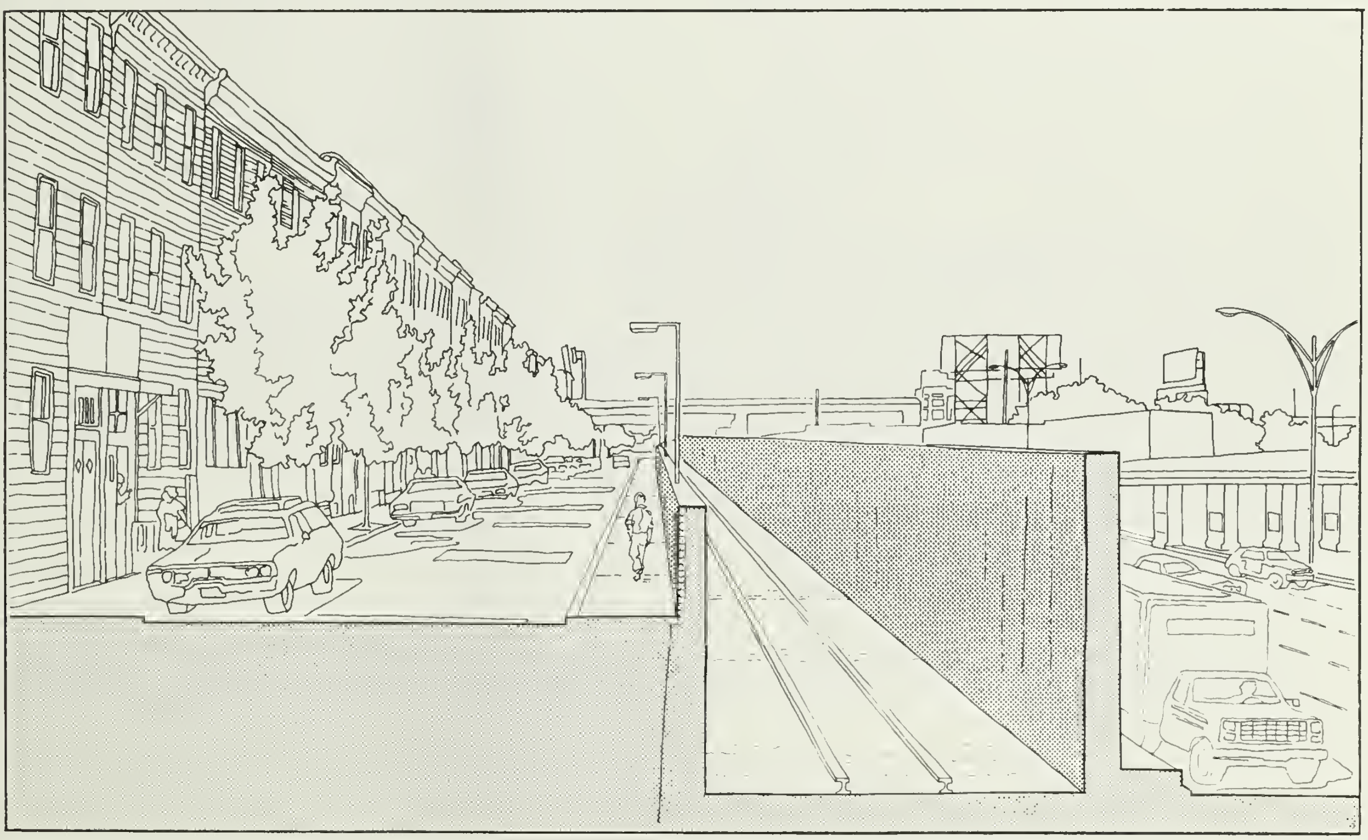


Figure 48

Alternatives 2 & 4, Option 1

Cut Away View Looking North on Bremen Street from Gove Street

Boston Waterfront.

4.15.4 Alternative 3

South Bay/Fort Point Channel

The visual impacts of Alternative 3 are the same as those of Alternative 2 in the South Bay and Fort Point Channel areas; see Section 4.15.3.

Jeffries Cove

View from the Road. Drivers entering the toll plaza from the Boston side will be briefly exposed to natural light briefly before re-entering another short tunnel section leading to the airport roadways. As the tunnel ramps merge with the airport roadways, drivers will have a clear view of landmarks such as the garage and airport control tower, which assist in orientation.

For drivers entering and leaving the planned Bird Island Flats (BIF) mixed-use development via the new Massport access road, the position of the ventilation building at a bend in the access road will make it a visual landmark and an orientation point. In effect, the ventilation building will serve as a visual entry point for visitors to the Bird Island Flats development.

View of the Road. The scale of the Jeffries Point neighborhood and Porzio Park on the waterfront, and their dramatic views across Boston Harbor to downtown Boston will not be affected by the project.

The industrial character of the Logan Airport southwest service area, with its large maintenance and air freight buildings widely dispersed among large parking lots, service roads, and taxiways, will not be altered by the toll plaza, ramps, and associated facilities.

Neither residents of Jeffries Point nor airport users will see the toll plaza, as it will be screened from view by walls and landscaping.

The gridiron street pattern of Jeffries Point is oriented such that views along residential streets do not terminate at the ventilation building. The structure will be partially visible from Porzio Park and the upper floors of some residences.

Pedestrian Environment. Porzio Park and the Jeffries Point Yacht Club provide public waterfront access and are important landscaped recreation areas for the densely developed Jeffries Point neighborhood. These facilities will be linked in a landscaped pedestrian esplanade to the proposed Bird Island Flats "walk-to-the-sea" by Massport; this esplanade may be temporarily disrupted by construction of the tunnel and then restored.

The new two-story MTA administration building will be integrated with the row of buildings and walls proposed by Massport to face the Cove and to act as a noise barrier next to the pedestrian walkway. The new building will be compatible with neighboring buildings on Maverick Street (see Figure 49 and 50), and its articulated facade will help to provide visual relief.

The new elements along the edge of Jeffries Cove associated with this alternative are aesthetically compatible with the existing environment and with proposed public improvements (see Figure 58).

4.15.5 Alternative 4

South Bay

The visual impacts of Alternative 4 are the same as those of Alternative 2 in the South Bay; see

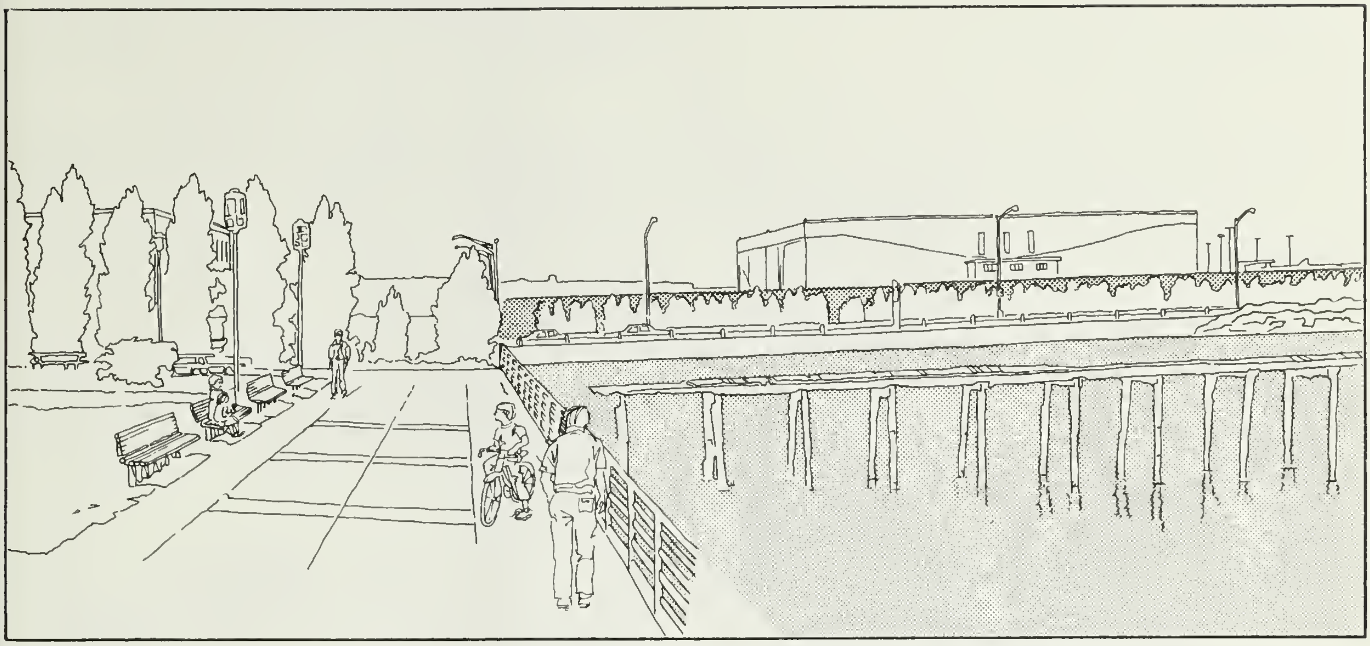


Figure 49
Existing View from Porzio Park North Toward Logan Airport

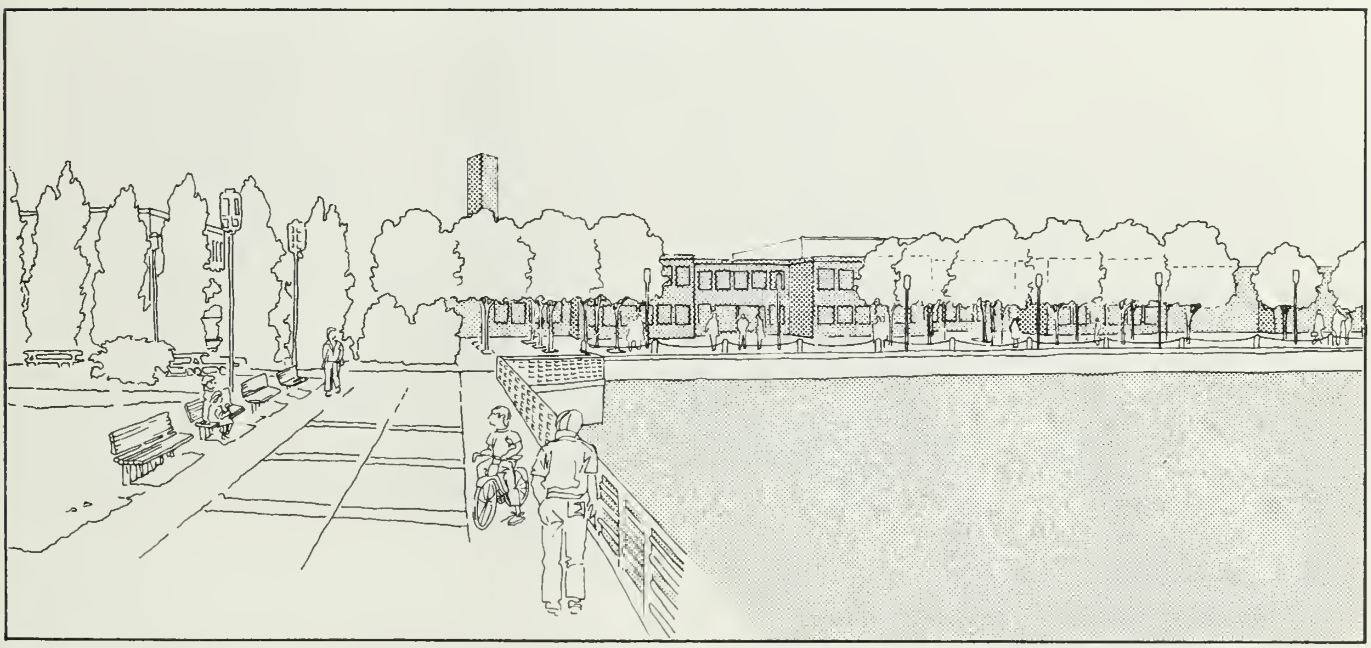


Figure 50
Alternatives 3 & 5, Options 1 & 2
View from Porzio Park North Toward Logan Airport and Bird Island Flats Park (by Massport)

Section 4.15.3.

Fort Point Channel

The visual impacts associated with this alternative will be similar in most respects to those of Alternative 2 in Fort Point Channel (see Figure 51).

View from the Road. The ramp to the Summer Street Bridge will provide a dramatic sequence of views for drivers entering Boston from the north via the tunnel. This ramp will partially block views of buildings along the skyline for drivers entering Boston from the south on Dorchester Avenue.

View of the Road. Alternative 4 will reduce the visible width of open water by approximately 50 percent immediately south of Summer Street, somewhat more than Alternative 2 (see Figures 51, 52, and 53).

Pedestrian Environment. The exit ramp from the tunnel to Summer Street will be at a higher elevation than the entrance ramp to the tunnel and will partially block pedestrians' views up and down the Channel. At the present time, pedestrians are restricted by the U.S. Postal Service from walking along the Boston side of the Channel. A sidewalk on relocated Dorchester Avenue will provide new pedestrian access to the downtown from the Broadway Station area of South Boston to Northern Avenue; however, portions of this new pedestrian way just south of Summer Street will be affected by traffic noise from the adjacent elevated ramp and views of the overhead structure.

East Boston Railroad Right-of-Way

The visual impacts of Alternative 4 are the same as those of Alternative 2 in the East Boston railroad right-of-way; see Section 4.15.3.

4.15.6 Alternative 5

South Bay

The visual impacts of Alternative 5 are the same as those of Alternative 2 in the South Bay area; see Section 4.15.3.

Fort Point Channel

The visual effects of Alternative 5 are the same as for Alternative 4 in the Fort Point Channel area; see Section 4.15.5.

Jeffries Cove

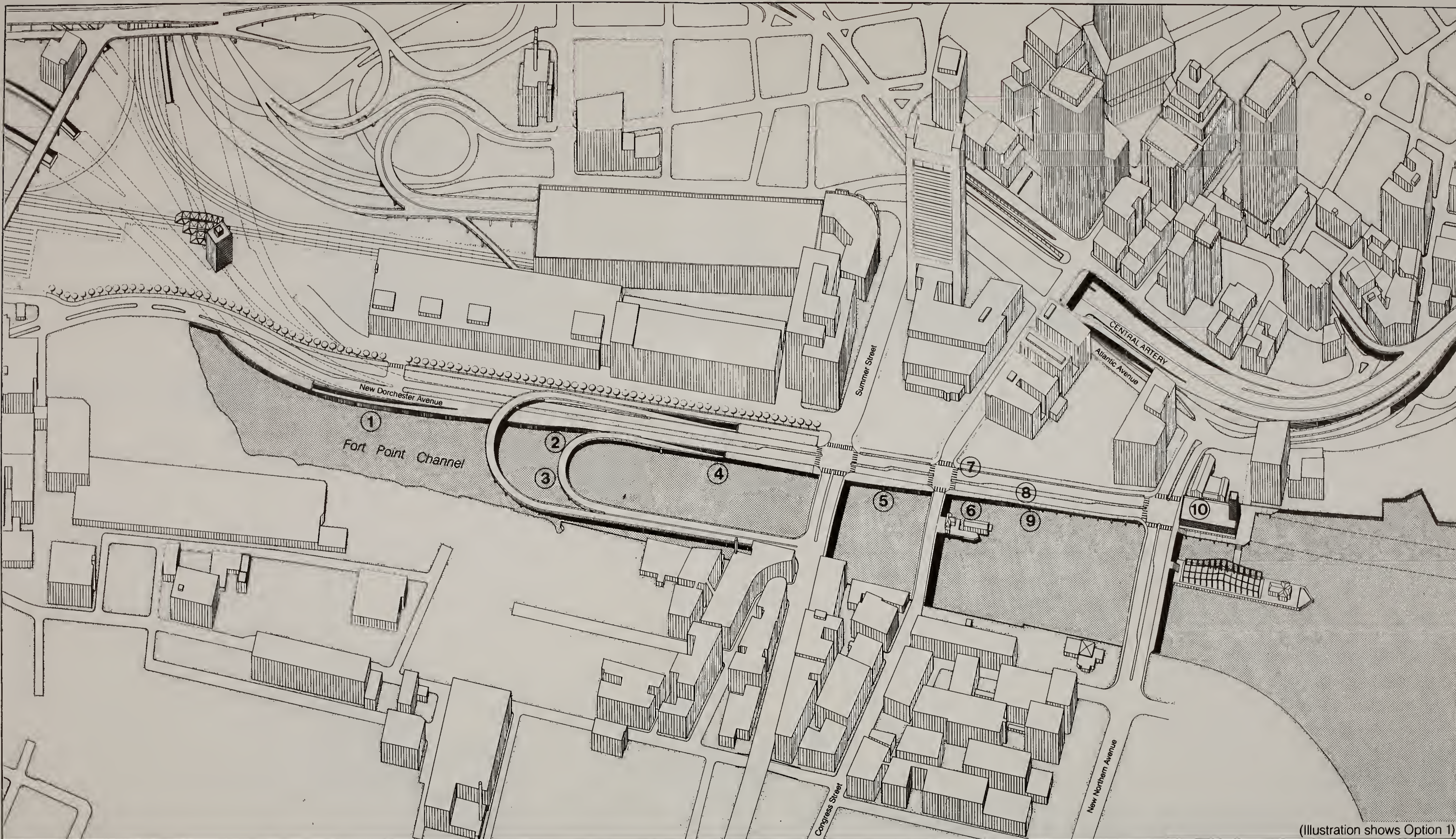
The visual impacts of Alternative 5 are the same as those of Alternative 3 in the Jeffries Cove area; see Section 4.15.5.

4.15.7 Urban Design and Joint Development Opportunities

Historically, the visual and environmental characteristics of highways have influenced the range of land uses adjacent to highway facilities. This project presents joint development and urban design opportunities to maintain and/or extend the range of compatible land uses and visual character in the South Bay, Fort Point Channel, East Boston railroad right-of-way, and Jeffries Cove/Logan Airport areas of the city.

This subsection focuses on two urban design options mentioned in Section 4.15.1: Option 1 is the base case for each build alternative, and includes features which are eligible under current Interstate funding (90-10).

The extra elements of Option 2 are not currently eligible for Interstate funding; other funding sources, including other Federal, State, local, and private sources, would be necessary for its implementation. Option 2 as described



Legend

1. Existing bulkhead line altered.
2. Tunnel projects 150 feet from existing bulkhead line into the Channel, reducing its width by 37 percent.
3. Overhead ramp, affects views from adjacent parcels.
4. Tunnel and northbound access ramps project a total of 220 feet from the existing bulkheads into the Channel, reducing its visible width by 50 percent.
5. Tunnel projects 145 feet from the existing bulkhead line into the Channel, reducing its width by 28 percent.
6. Symmetry of the existing bridges is altered.
7. New pedestrian way provided along entire length of Channel; pedestrian access controlled by signalized intersections.
8. Introduction of traffic parallel to the Channel affects the area's character.
9. Tunnel projects 120 feet from the existing bulkhead line into the Channel, reducing its width by 22 percent.
10. Placement of the ventilation building in the Channel affects views and alters the building line.

(Axonometric Drawing)

Figure 51
Alternatives 4 & 5 Summary of Aesthetic Impacts

0 350 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

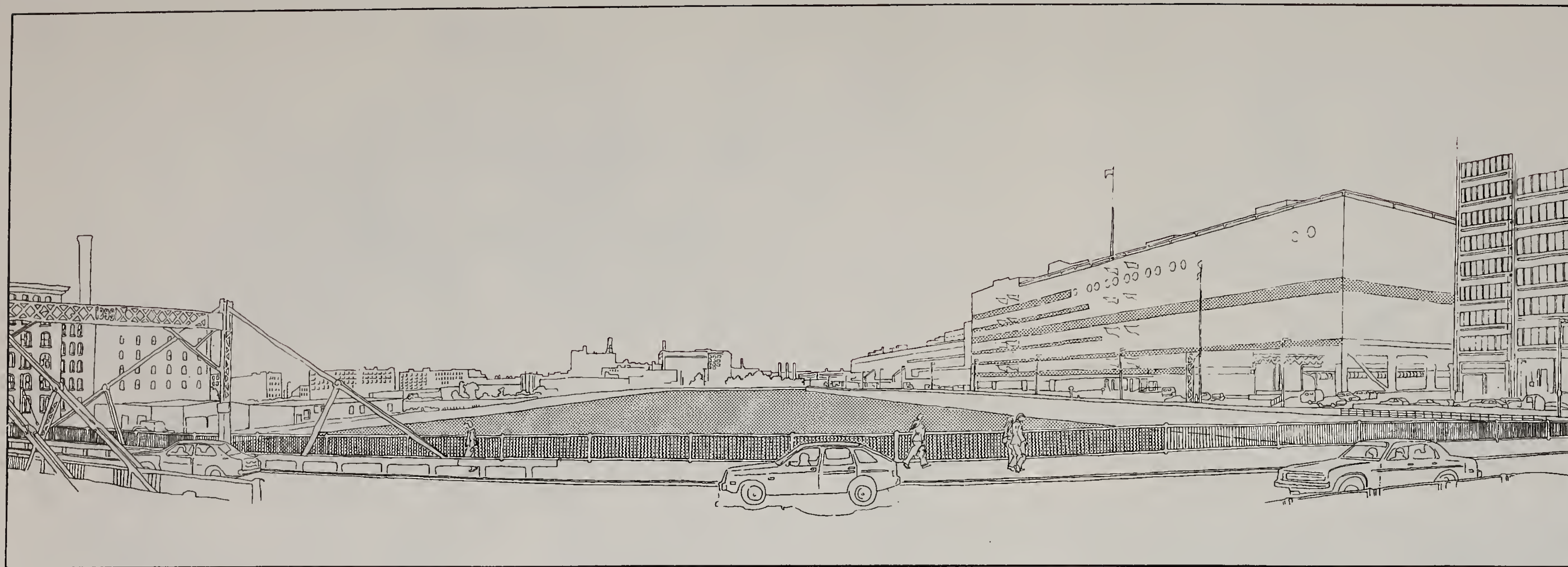


Figure 52
Existing View from Summer Street Bridge Looking South

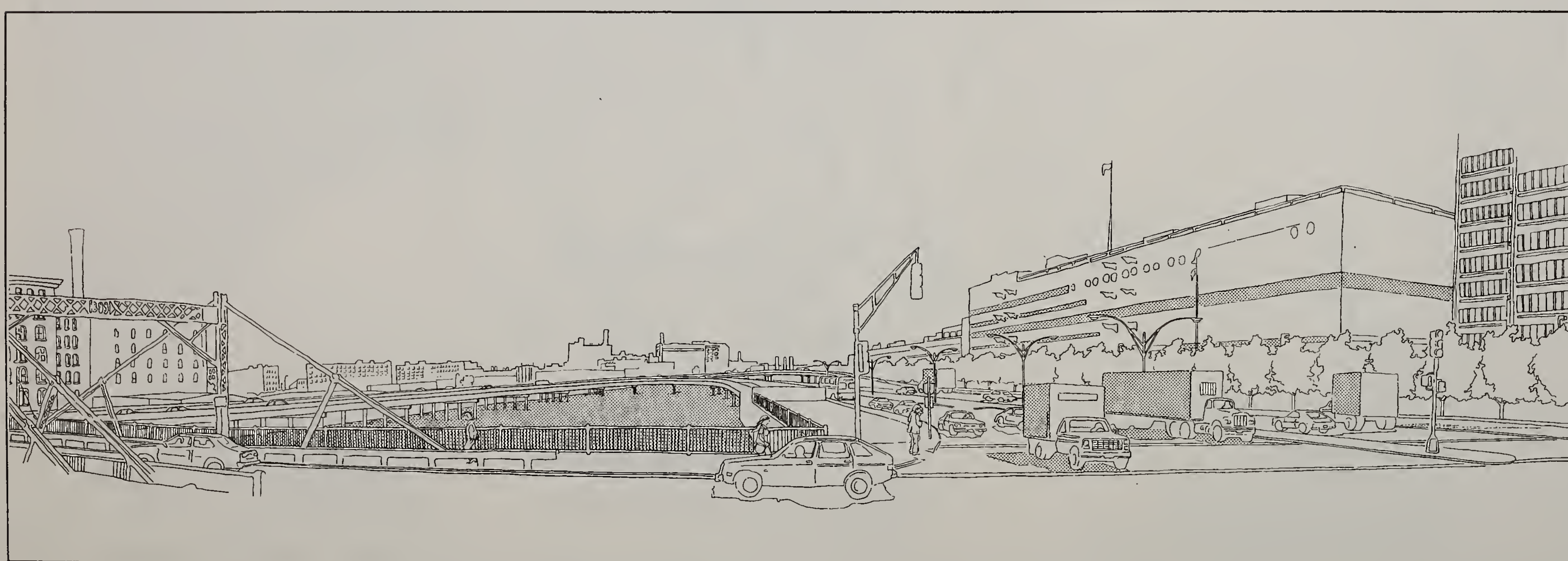


Figure 53
Alternatives 4 & 5, Option 1
View from Summer Street Bridge
Looking South

here represents potential amenities subject to both funding availability and design refinements.

Alternative 2

South Bay

Many urban design measures are common to both Options 1 and 2 (see Figure 54). In both options, residual parcels between the West Fourth Street Bridge and the Broadway Bridge will be turned over to the Metropolitan District Commission (MDC) for its proposed Combined Sewer Overflow facility. Any small residual parcels not required for the MDC project will be graded, loamed and seeded. Smaller residual parcels adjacent to this right-of-way could be turned over to the MBTA and other contiguous property owners.

In Option 1, the parcel between Broadway and Dorchester Avenue created by filling that portion of the Channel will be graded, loamed and seeded. The historic railroad bridge could be retained and the ventilation building would be constructed adjacent to it.

In Option 2, the parcel between Broadway and Dorchester Avenue and the elements within it, could be designed to reflect the importance of this site as a "visual gateway" for drivers entering Boston from the south and west. The existing 19th century granite bulkhead and cast iron railing along the Channel could be retained, and an appropriate treatment developed for the railroad bridge; the appearance of the ventilation building could be enhanced through facade treatment.

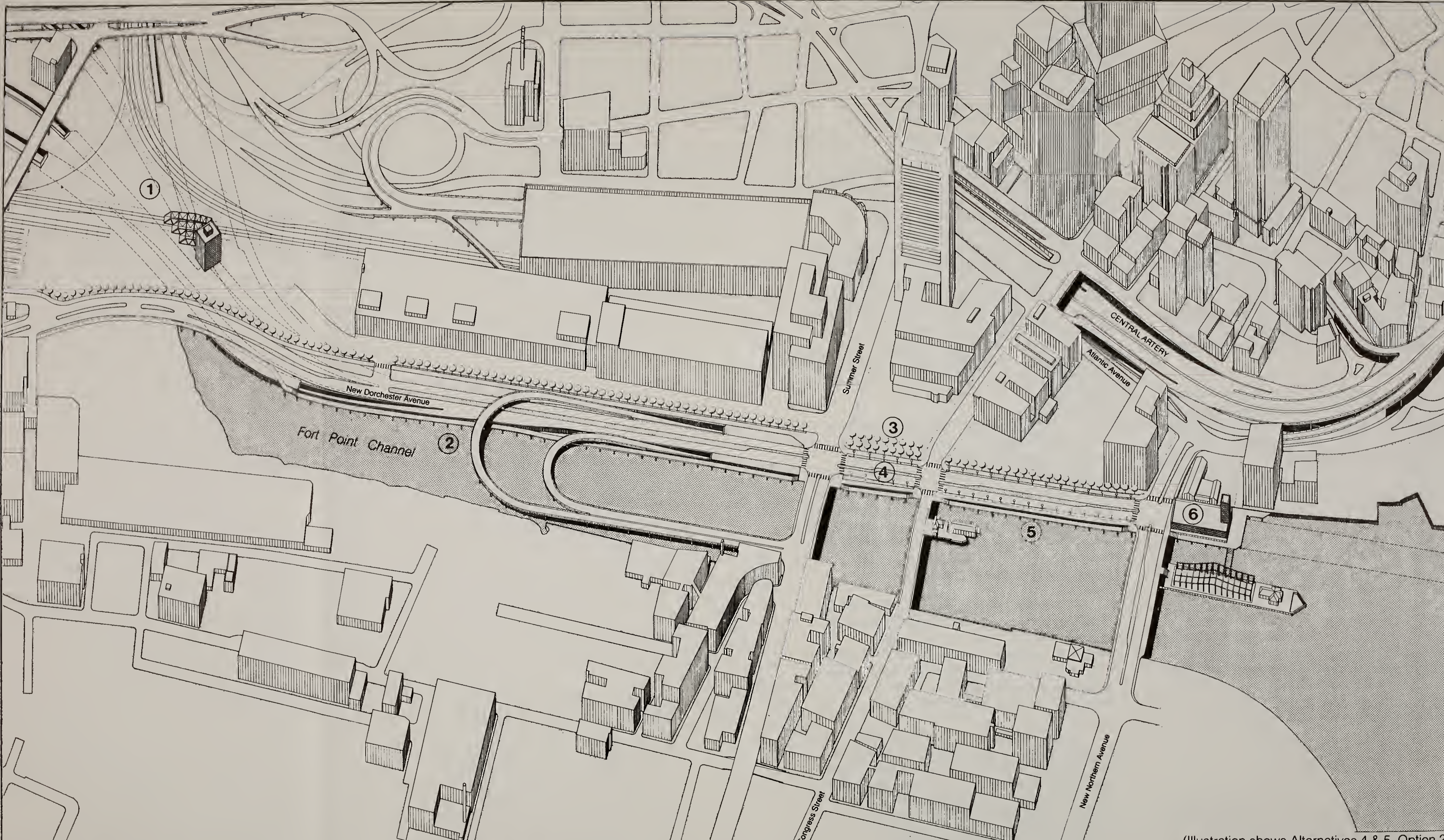
Fort Point Channel

In the Fort Point Channel, pedestrian access to the water's edge and marina or other water-oriented activities will be maintained and improved in both options. A waterfront pedestrian esplanade will extend from the relocated Northern Avenue Bridge across the new Dorchester Avenue Bridge into South Boston (see Figure 54). This pedestrian walkway will intersect the Congress Street and Summer Street bridges at grade, and will be accessible for the handicapped; provisions for bicycle access may also be provided. Under both options, the west side of relocated Dorchester Avenue will become a linear landscaped buffer strip with a line of trees extending from relocated Northern Avenue to the new Dorchester Avenue Bridge. The existing granite bulkhead will be replaced by new, but similar granite facing, and the new Summer Street ramp will be designed with the longest spans feasible to minimize its visual impact on the Channel. Opportunities for air-rights development over new Dorchester Avenue have been examined and appear to be impractical.

In Option 1, the ventilation building will be located in the Channel adjacent to the existing Northern Avenue Bridge. This masonry structure will be positioned to allow for a pedestrianway connecting the new Dorchester Avenue pedestrian esplanade with the city's proposed pedestrian walkway along the harbor edge at Rowe's and Foster's wharves.

Residual parcels on the west side of relocated Dorchester Avenue can be turned over to adjacent property owners in Option 1. Lighting on relocated Dorchester Avenue will consist of conventional overhead street lighting fixtures.

In Option 2, the residual parcel on the west side of relocated Dorchester Avenue, between Congress and Summer Streets, can be developed as a mini-park or plaza in front of the proposed Federal Reserve Bank tower addition. The waterfront pedestrian esplanade would be widened to include a lower-level walkway, giving direct access to proposed



(Illustration shows Alternatives 4 & 5, Option 2)

Legend

1. Ventilation building architecturally enhanced; Option 2.
2. Continuous pedestrian walk allows access to potential marina; Option 2.
3. Landscaped mini-park; Option 2.
4. Pedestrian scale lighting, special paving materials, and landscaping parallel to sidewalk; Option 2.
5. Lower level pedestrian walkway is screened from traffic on new Dorchester Avenue; Option 2.
6. Ventilation building designed to minimize visual impact; Options 1 and 2. Ventilation building designed to allow joint development; Option 2.

(Axonometric Drawing)

Figure 54
Alternatives 2, 3, 4 & 5 Measures to Minimize Harm

0 350 Feet

marina activities in the Channel. Pedestrian walkways on both sides of new Dorchester Avenue would feature pedestrian-scale lighting, benches, and special paving materials. Illumination for relocated Dorchester Avenue could be provided by fixtures in low bollards or walls parallel to the road (see Figures 55 and 56).

The ventilation building could be designed to accommodate joint use of air rights. For example, if a mid-rise office building were to be constructed on the Hook Lobster Co. site, a roof deck could be built out over the mechanical portion of the building, connecting the office tower with the edge of the Channel and capitalizing on the expansive view of Boston Harbor.

East Boston Railroad Right-of-Way

Options 1 and 2 are substantially different in this corridor, principally as relate to the necessity of maintaining a right-of-way for a single Conrail track. In Option 1, this track will be located in an open boat section, while in Option 2, the depressed rail line would be covered and landscaped. While Conrail's future plans for this trackage are uncertain, continued use has been assumed.

In Option 1, a low wall will parallel the sidewalk on the east side of Bremen Street, screening the view into the railroad right-of-way. The wall will be higher between Gove and Porter Streets, so that views of the open toll plaza would be screened as well; two small triangular passive green spaces will be included at the intersections of Bremen and Porter Streets and Bremen and Marginal Streets. The sidewalk and wall will run along the remaining length of Bremen Street (see Figure 48).

Along the west side of Orleans Street, between Gove and Porter Streets, a landscaped buffer strip will be developed to soften the appearance of the wall screening the open toll plaza.

Residual parcels between Gove Street and Marginal Street would be returned to their original grade and seeded as passive green spaces, providing visual impact mitigation for the adjacent toll plaza and ventilation building (see Figure 45). Pedestrian access to these parcels would not be provided. (The surface rights to the parcel over the tunnel structure between Marginal Street and the harbor could be returned to Massport and incorporated into proposed developments on the contiguous parcels.)

In Option 2, the toll plaza would be partially covered, increasing the extent of mitigation. A continuous landscaped pedestrianway would run from Porter Street to the harbor along the east side of Bremen Street. This 25-foot wide landscaped buffer strip would partially screen the appearance of the wall enclosing the toll plaza and would include pedestrian-scale lighting, benches, and special paving materials (see Figures 58 and 59).

The Orleans Street parcels would be landscaped. The MTA administration building would be located on air-rights over the toll plaza, freeing approximately 25,000 square feet of land for other uses.

Parcels between the Gove Street pedestrianway and Marginal Street, totalling approximately four acres,

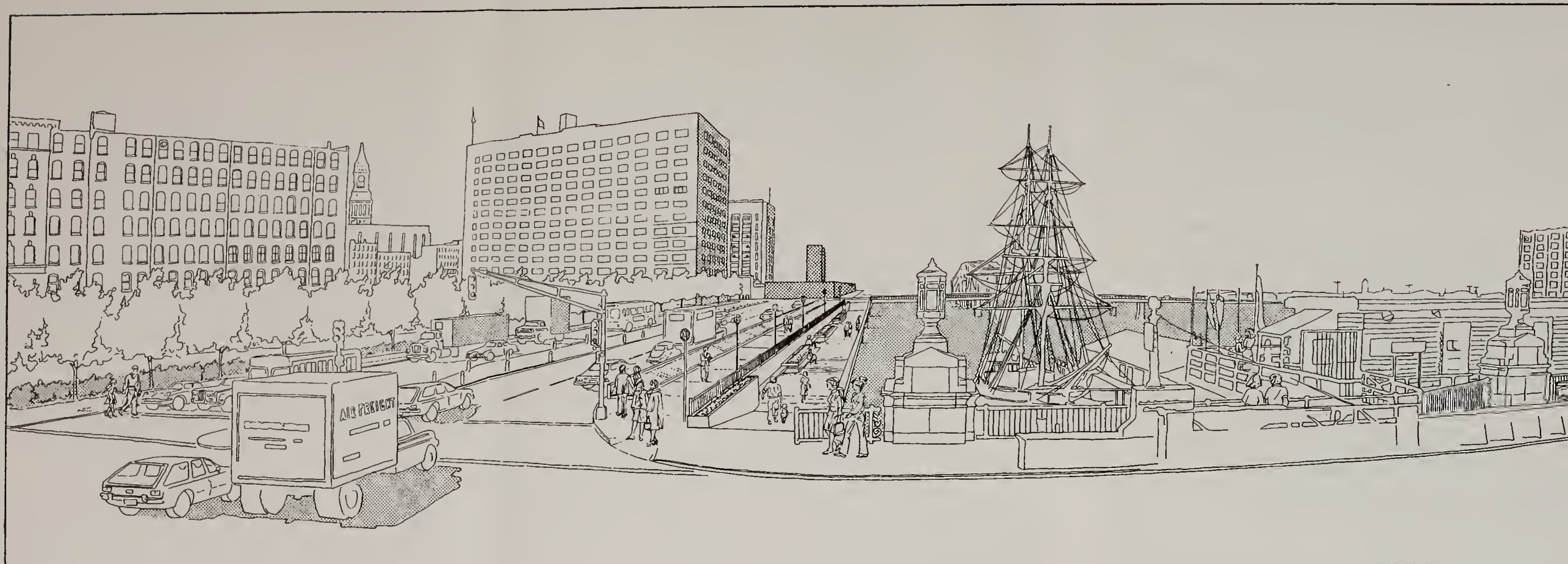


Figure 55
Alternatives 2, 3, 4 & 5, Option 2
View from Congress Street Bridge North Toward the Harbor

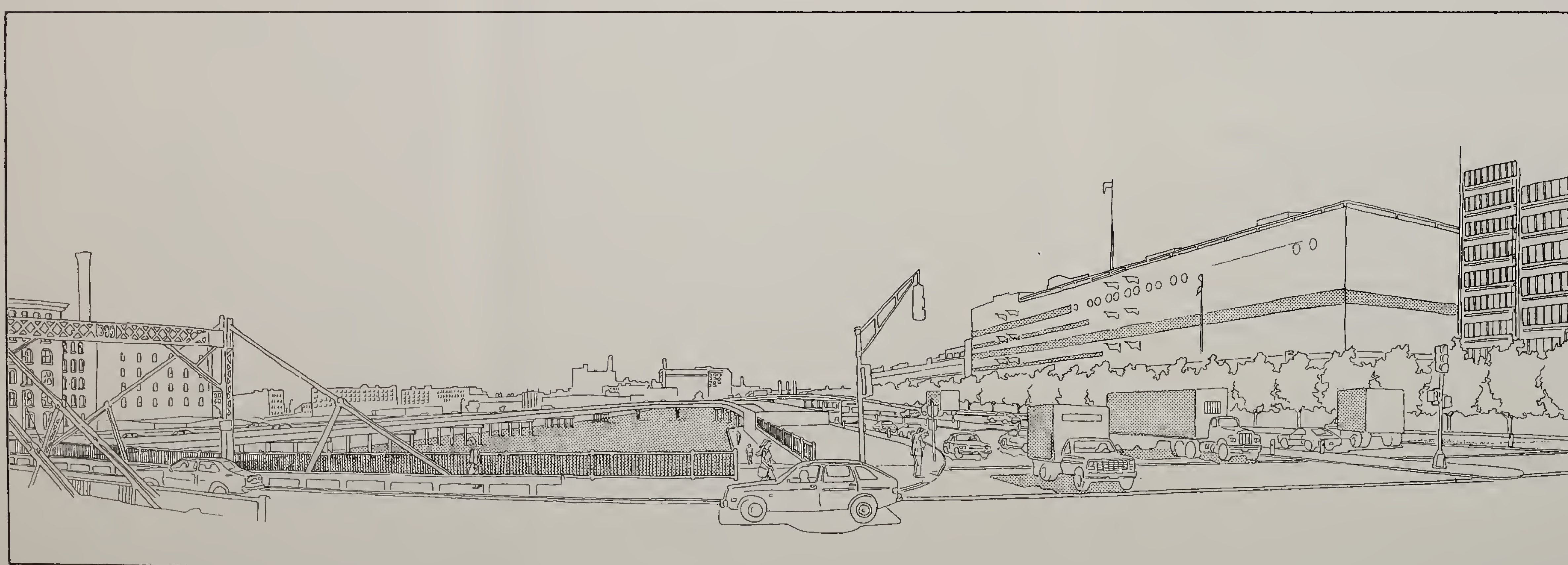


Figure 56
Alternatives 4 & 5, Option 2
View from the Summer Street Bridge Looking South

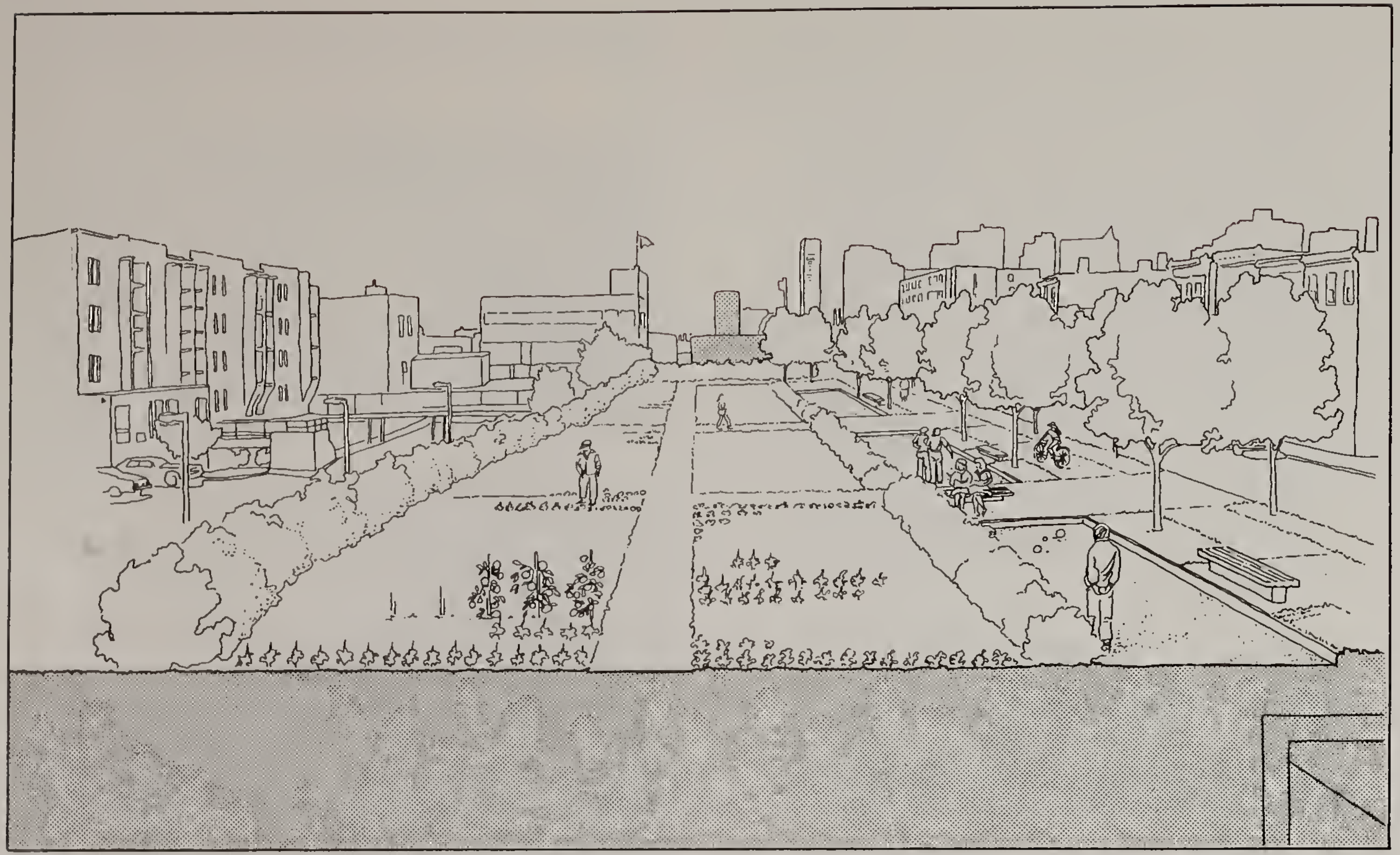


Figure 57
Alternatives 2 & 4, Option 2
Cut Away View Looking from the Maverick Street Bridge South Toward the Harbor

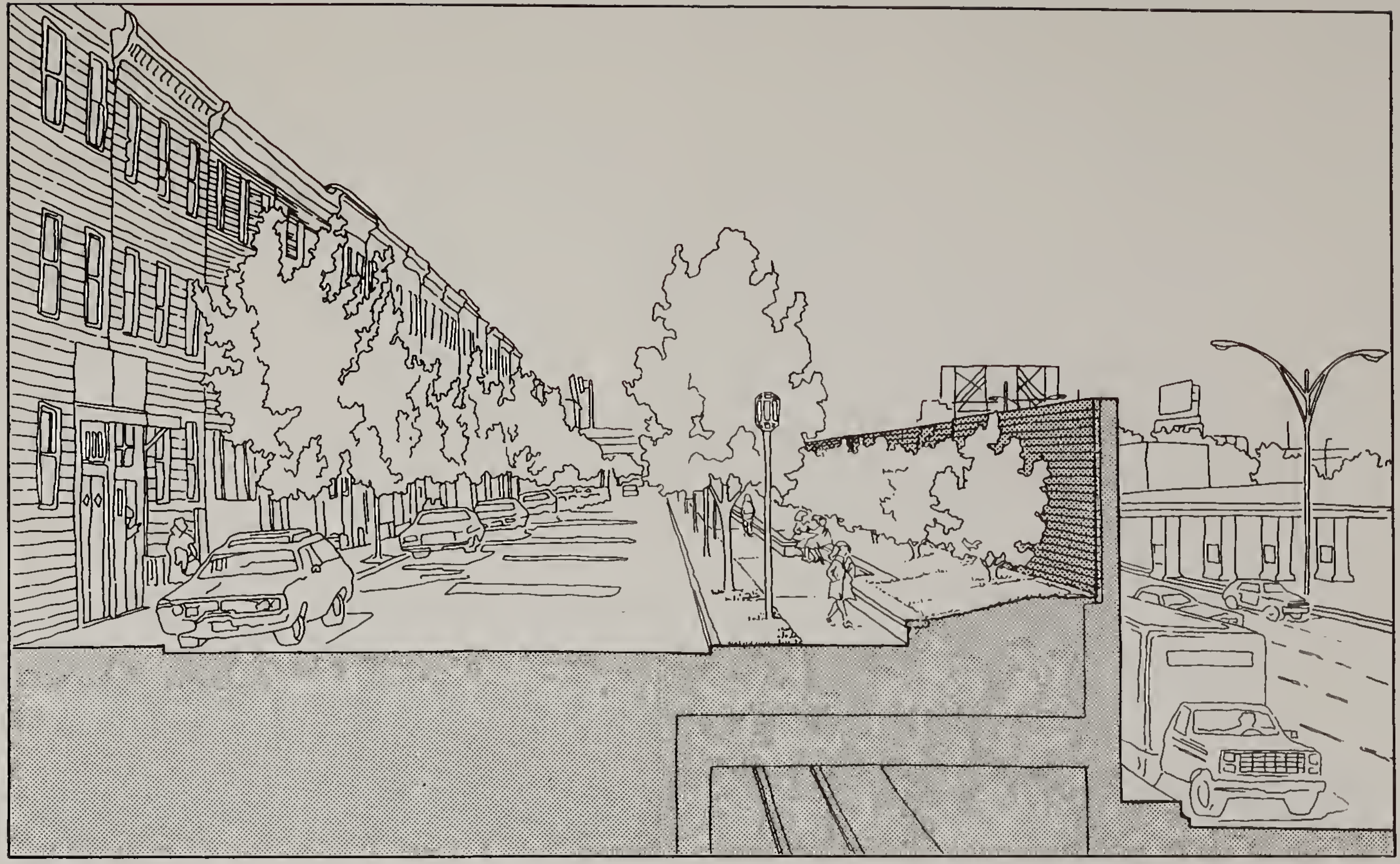


Figure 58
Alternatives 2 & 4, Option 2
Cut Away View Looking North on Bremen Street from Gove Street

Legend

1. Ventilation building architecturally enhanced.
2. Landscaped pedestrian walk along Bremen Street between Marginal and Porter Streets.
3. Relocated railroad right-of-way covered to allow community use of air-rights parcels as active and passive recreation space.
4. MTA Administration building on air-rights frees up additional land for community use, making approximately 50 percent of the corridor available.
5. Additional cover constructed over the toll plaza.

(Axonometric Drawing)

Figure 59
Alternatives 2 & 4, Option 2
Measures to Minimize Harm

0 350 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

could be created by fill on top of the tunnel structure to match the grade of contiguous streets and properties, and would be available for a variety of uses (see Figure 57). Although it would be possible to build four- to six-story buildings on these parcels, the additional cost for foundations and site preparation make such development unlikely. It is assumed that the land would be used as active and passive recreational open space, and that the specific nature of its use and design would be developed in concert with the East Boston community. This joint development would mitigate community and visual impacts.

The ventilation building in Option 2 would have the same configuration as in Option 1. Architectural enhancement of the building, however, would be provided with Option 2.

Alternative 3

South Bay/Fort Point Channel

In Alternative 3, the urban design and joint development opportunities would be the same as those discussed previously for Alternative 2 for South Bay and Fort Point Channel.

Jeffries Cove

In Option 1, the toll plaza area would be open and the ventilation building would be a masonry structure.

In Option 2, the toll plaza could be partially covered, making approximately 15,300 square feet of land available for other uses; appearance of the ventilation building would be enhanced by architectural treatment of the building (see Figure 60).

The proposed toll plaza, MTA administration facilities, and ventilation building would be designed to mitigate visual and land use impacts through a site configuration which takes the least amount of land, interferes least with existing Massport operations and land uses, and would be consistent with the Logan Airport Land Use Master Plan.

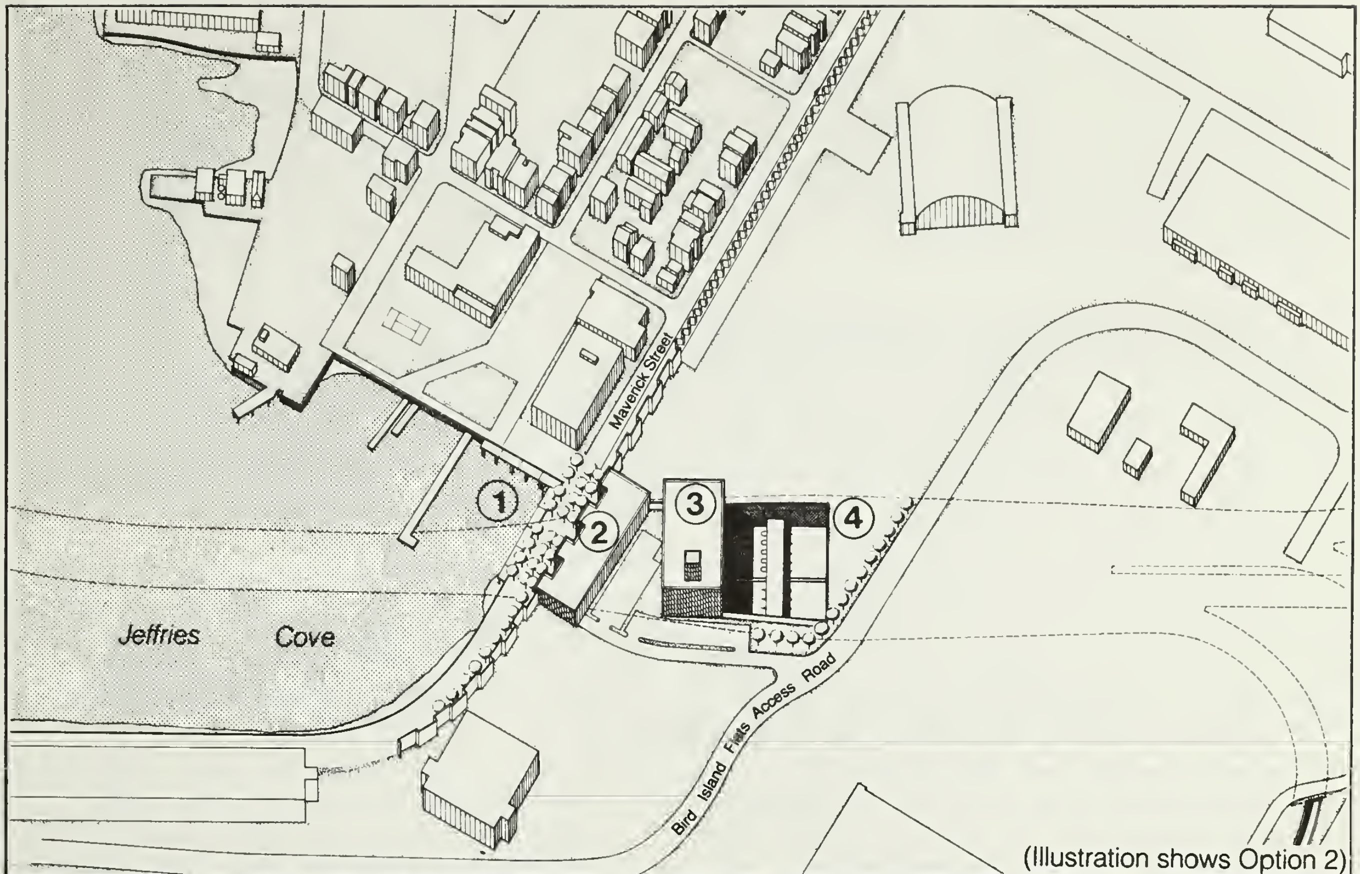
In either option, the toll plaza will be surrounded with a masonry wall at a height sufficient to screen the plaza from the view of passing pedestrians and drivers. MTA parking access could be shared with the Eastern Airlines Reservation Center via a connection to the new Bird Island Flats access road. There will be a landscaped buffer strip between the toll plaza and the BIF access road, designed to be consistent with Massport's proposed landscape treatment. As in Option 1, the ventilation building would be located as far from the Jeffries Point neighborhood as possible in a position partially screened from view by the administration building, which would be integrated with Massport's proposed noise barrier.

Alternative 4

For a discussion of the urban design measures to mitigate visual impacts of this alternative, see the previous discussion for Alternative 2.

Alternative 5

For a discussion of mitigating urban design and joint development opportunities, see the previous discussions for South Bay and Fort Point Channel (Alternative 2), and Jeffries Cove (Alternative 3).



1. BIF Park (by Massport) replaced; Options 1 & 2.
2. MTA Administration building integrated with Massport's proposed noise barrier; Options 1 & 2.
3. Ventilation building designed to minimize visual impact; Options 1 & 2. Ventilation building architecturally enhanced; Option 2.
4. Partially covered toll plaza and landscaping parallel to BIF Access Road; Option 2.

Figure 60
Alternatives 3 & 5, Aesthetic Impacts and Measures to Minimize Harm

0 350 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

4.16 ENERGY

Transportation consumes the most rapidly depleting form of energy--petroleum. It also accounts for a significant portion of overall energy consumption.

Transportation-related energy is usually separated into two main categories: "Direct", defined as the energy consumed in the actual propulsive effort of a vehicle, such as the thermal value of the fuel, and "Indirect", which is all the remaining energy consumed to operate a transportation system.

Indirect energy may be divided into two main broad subcategories: central energy use and peripheral energy change. Central energy use encompasses all the energy resources used indirectly in building and operating a transportation system. It addresses the fact that energy must be expended to create and support a transportation system; for example, energy consumed in mining and refining raw materials into useful products such as vehicles or roadways.

Peripheral energy change recognizes energy resources that are not used in any manner by the system itself. Rather, it addresses the

potential effect that a transportation system may have on energy use and availability in the area it services. For example, a shift in population density, land use, or transportation patterns may be fostered, or induced, by a project, which will have an impact on energy demand, supply, and distribution within a certain geographical area.

This energy study predicts the effect that the proposed project will have on the consumption of energy. Each of the four build alternatives will require a substantial one time energy expenditure related to the construction materials, operations, and equipment. All of the build alternatives will require similar maintenance after construction.

The major input for the direct energy calculations (volumes and distribution of traffic) for all build alternatives and the No-Build Alternative are detailed in Appendix 4 and summarized in Chapter 10.0, Energy Analysis, in the Supportive Engineering Report. Vehicle-miles and vehicle-hours used in the energy analysis are for the year 2010.

For the No-Build Alternative, the energy savings in materials and construction activities must be balanced by the fact that this alternative will result in increased congestion on an already severely taxed highway system. Increased traffic congestion will cause an increase in fuel consumption of a portion of the total vehicles operating in the project area.

Table 52 provides the results of the energy analysis in terms of equivalent annual energy consumption by each alternative for the year 2010. Construction energy, and vehicle indirect energy values have been pro-rated according to estimated useful lives (100 years for tunnels and ventilation buildings; 50 years for bridges; 25 years for pavement, subbase, drainage structures, etc.; 10 years for lanscaping), thus providing meaningful comparisons.

The results in Table 52 indicate that the No-Build Alternative should be the most energy efficient. This could result from the fact that the build alternatives result in induced traffic being attracted to the highway network, particularly to Logan Airport, as a result of improved accessibility (approximately 12,800 vehicles per day). Increases in energy consumption due to the build alternatives, however, is only on the order of one percent of the energy consumed for the No-Build Alternative. A difference of this magnitude indicates that all alternatives would be essentially equal with respect to energy consumption.

There is no formal statewide or regional transportation energy plan.

4.17 LYNN HARBOR FABRICATION SITE

This site has been identified as the preferred concrete tube fabrication site; additional potential fabrication sites have been identified previously in Section 4.1.1.

The Lynn Harbor fabrication site and its relationship to surrounding features is shown in Figure 61.

The site is presently owned by the America East Corporation which, with the City of Lynn's Economic Development and Industrial Corporation, is pursuing development of the site into a multi-use marine facility. Consultation with America East Corporation has taken place and included site visits. The temporary use of the property for fabrication of concrete tunnel sections is acceptable to the owner under the present schedule for construction of the tunnel. At the present time, the site is totally undeveloped, being used for refuse and construction excavate disposal. Travel through the site is difficult given the extent of potholes, ruts, and mud. There is a point of vehicular access off Route 1A at each end of the site. The Commonwealth's Metropolitan District

Table 52

ANNUAL EQUIVALENT ENERGY CONSUMED (BTU's)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Direct Energy					
Cars	8.923×10^{12}	8.907×10^{12}	8.908×10^{12}	8.907×10^{12}	8.932×10^{12}
2-Axle, 6-Tire Trucks	3.561×10^{12}	3.555×10^{12}	3.555×10^{12}	3.555×10^{12}	3.565×10^{12}
Tractor-Semitrailer Trucks	2.954×10^{12}	2.950×10^{12}	2.951×10^{12}	2.950×10^{12}	2.959×10^{12}
Total, Direct Energy	1.544×10^{13}	1.541×10^{13}	1.541×10^{13}	1.541×10^{13}	1.546×10^{13}
Indirect Energy					
Vehicle-related	1.632×10^{13}	1.641×10^{13}	1.641×10^{13}	1.641×10^{13}	1.645×10^{13}
Facility Construction	0	1.204×10^{11}	1.367×10^{11}	1.197×10^{11}	1.371×10^{11}
Facility Maintenance	0	3.62×10^{9}	4.16×10^{9}	3.44×10^{9}	4.01×10^{9}
Power	0	7.837×10^{10}	9.316×10^{10}	7.837×10^{10}	9.316×10^{10}
Peripheral Effects	0	0	0	0	0
Total, Indirect Energy	1.632×10^{13}	1.661×10^{13}	1.664×10^{13}	1.661×10^{13}	1.668×10^{13}
Total Energy Expended Annually:	3.176×10^{13}	3.202×10^{13}	3.205×10^{13}	3.202×10^{13}	3.214×10^{13}
Total energy in terms of equivalent barrels of crude oil per day:	15,002 Bbl	15,125 Bbl	15,139 Bbl	15,125 Bbl	15,182 Bbl
% Energy Consumption Greater than Alternative 1 (No-Build)	-	0.82	0.91	0.82	1.20

- ■ COE Maintenance Dredging
- ● COE Port of Lynn Sampling Sites
- Proposed Breakwater for Port of Lynn
- Proposed Dry Dock
- Mussel Beds/Tide Flats
- Land Based Area

Figure 61
Lynn Harbor Fabrication Site

0 500 1000 2000 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Commission owns a public fishing pier off the southern bulkhead of the property. Public access to the pier is provided by a right-of-way from the property owner.

Modifications of this site for fabrication of the tunnel sections include facilities for construction of concrete forms, a batch concrete plant, other support operations, and worker parking. Two dry docks will also be constructed in Lynn Harbor (off the America East property) within which the tunnel sections would be fabricated (see Section 9.1 of the Supportive Engineering Report). The site and dry docks would be in place for approximately three years after which they would be removed.

The dry docks would be constructed by excavating the basin of each within the Harbor and using the excavated sand as the berm. Once the berms have been constructed, the basins would be dewatered and fabrication of tunnel sections would commence. Upon completion of all sections in a dry dock, the area would be flooded, the end retaining wall opened, and the sections floated out at high tide. Should parts of the ship channel be of inadequate depth for removal of the tunnel sections, channel deepening will also be required. After the last section is floated out, the basins would be demolished.

The fabrication site would be compatible with existing zoning and the same site has been considered by the City of Lynn in the past as a potential location for the Port of Lynn project. The Harbor is also a "designated port" by the Office of Coastal Zone Management.

Land portions of the site are highly disturbed, rutted and/or potholed by vehicular traffic. The site is used in part for parking by fishermen and by others for refuse disposal. The land area, which is retained by a wooden bulkhead, appears to have been used as a past dredge spoils disposal area. Aesthetic and ecological values of the site are limited.

The following sections describe the conditions of marine sediments within and near the site, marine resources, vegetation and wildlife, and wetlands.

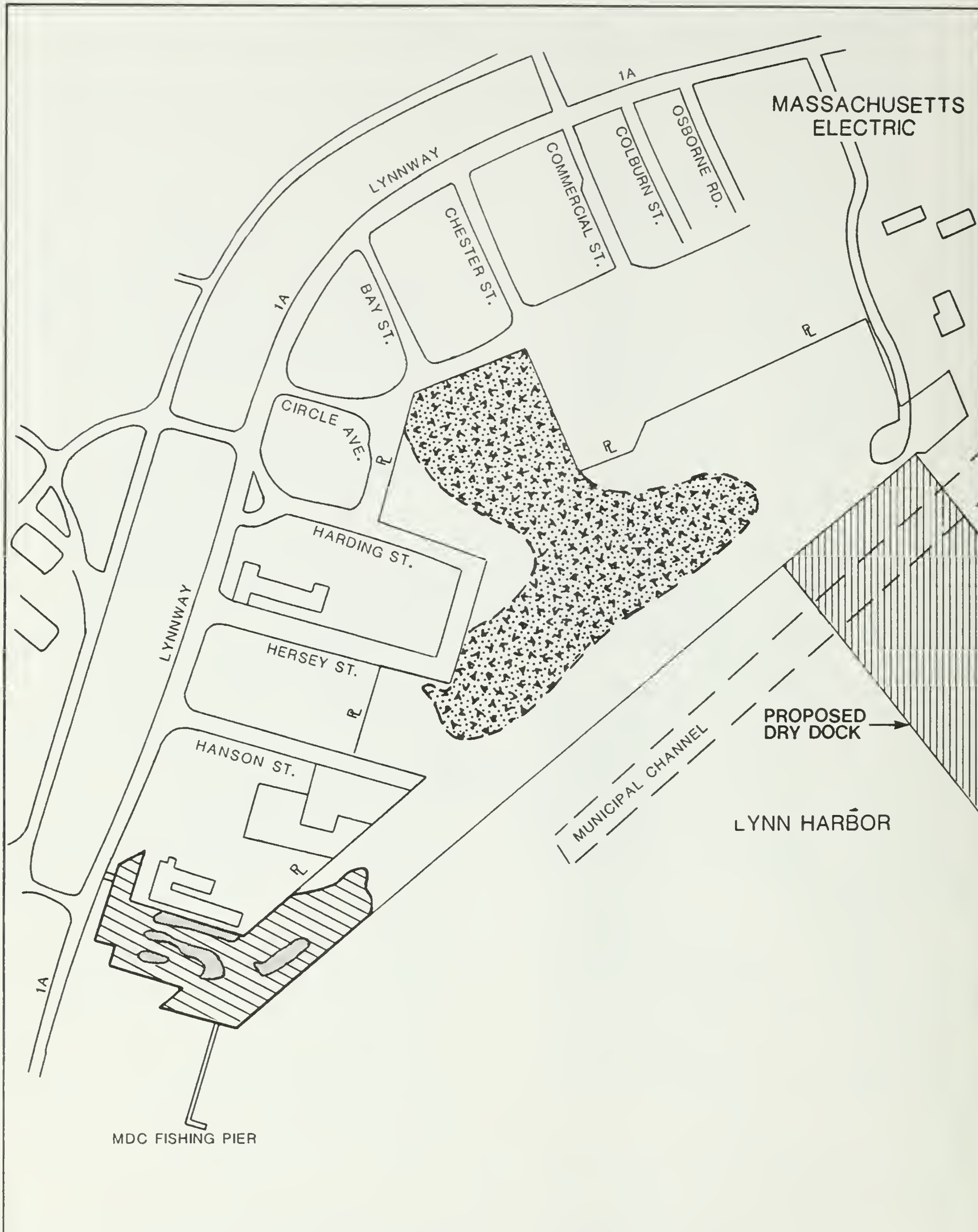
4.17.1 Lynn Harbor Sediments

Sediment samples were collected at six locations (Figure 62) within Lynn Harbor during a 1979 COE study on the Port of Lynn project and analyzed for physical and chemical quality characteristics.

The bottom sediments of Lynn Harbor consist of fine sands and silts covered intermittently by mussel beds.

Mean concentrations of all chemical constituents are within the Massachusetts Dredge Material Classification range of Category 1 (uncontaminated), with the exception of mercury, which was within Category 2 (marginally contaminated) at all six sampling locations (Table 53). Chromium was detected at Category 2 levels at Station PE-1, and was at the upper level of Category 1 at Station PE-3 and PE-5. In all three instances, the higher levels of chromium were detected in the upper one foot of sediment. Cadmium, lead, and vanadium were detected at Category 2 levels in the upper foot of sediment at location PE-6. Cadmium and lead levels at this location were immediately above Category 1 levels, while vanadium was well within Category 2. Testing for PCBs was conducted at one station (PE-1), and levels were within Category 1. Percent volatile solids (the organic fraction of the sediment) and percent oil and grease were within Type A levels at all locations and depths.

In association with its maintenance dredging program, COE also conducted chemical analyses of sediments in the channel leading into Lynn Harbor during 1979 (see Figure 61). The results of those analyses indicated that the mean concentrations



Refuse Piles
Wetland Plants
100-Year Floodplain

Figure 62
Lynn Harbor Fabrication Site—Land Based Area

0 600 Feet

EIS/EIR for I-90, The Third Harbor Tunnel

Table 53

CHEMICAL PROPERTIES OF LYNN HARBOR SEDIMENTS
(mg/kg)

Parameter	No. of Samples	Range	Mean	Standard Deviation	DWPC Classification*
Arsenic	10	1.0-6.0	3.1	± 1.6	Category 1
Cadmium	10	2.0-5.0	2.5	± 0.9	Category 1
Chromium	10	16.0-140.0	57.2	± 40.3	Category 1
Copper	10	6.0-60.0	24.0	± 16.5	Category 1
Lead	10	5.0-100.0	41.0	± 31.8	Category 1
Mercury	10	0.6-1.0	0.8	± 0.1	Category 2
Nickel	10	6.0-43.0	17.6	± 10.0	Category 1
Vanadium	10	10.0-110.0	42.4	± 27.1	Category 1
Zinc	10	13.0-140.0	60.8	± 41.5	Category 1
PCBs	1	—	0.09	--	Category 1
% Fines	6	15.0-88.0	48.3	± 32.8	Type A/B
% Volatiles (NED Method)	6	0.5-2.72	1.67	± 0.84	Type A
% Oil and Grease	6	0.027-0.160	0.070	± 0.047	Type A
Mean Grain Size (mm)	6	0.040-0.0310	0.110	± 0.095	Not Applicable

*Massachusetts Division of Water Pollution Control

of all chemical constituents are within the Massachusetts Dredge Material Classifications of Category 1, Type A, with the exception of mercury, which occurred consistently at Category 2 levels (0.6-1.0 ppm). Cadmium, chromium, and vanadium each exceeded the Category 1 limits in individual samples, but never exceeded Category 2 concentrations. Percent silt-clay and percent water were at Type B levels in some individual samples, but the means are well within Type A criteria. Three phase bioassay and bioaccumulation tests have been conducted on the channel sediments and the test results indicate that the sediments are acceptable for disposal at the Massachusetts Bay Foul Area. The compatibility of sediments with open water disposal demonstrates the relatively good quality of the Harbor sediments.

4.17.2 Marine Resources

Lynn Harbor is a highly productive marine environment dominated by tide flats and shallow water habitat. Soft shell clam beds are found in Lynn Harbor as well as extensive mussel beds as shown on Figure 61. Within the area considered for the fabrication site, mussel beds are scattered. Worms constitute the dominant benthic populations. Common finfish species include Atlantic silverside, mummichog, banded killifish, stickleback, winter flounder, yellowtail flounder, tomcod, ocean pout, longhorn sculpin, white hake, and skate.

The Pines and Saugus Rivers are important winter flounder nursery areas supporting modest rainbow smelt and river herring runs. Lynn Harbor supports a recreational fishery for adult winter flounder year-round, and a seasonal fishery for cod, mackerel, pollock, and bluefish.

The Pines and Saugus Rivers as well as Lynn Harbor provide significant intertidal habitat consisting of mud and sand flats for soft shell clams and blue mussels. Information from the Massachusetts Division of Marine Fisheries has indicated that in 1968 and 1978, there was a significant soft shell clam population along the entire length of the fabrication site bulkhead (the Mull Free bed). However, recent sampling during this study indicated that the soft shell clam population is no longer present. Under the Clean Water Act guidelines, such intertidal areas are considered and evaluated as "special aquatic sites."

4.17.3 Wetlands

Wetlands regulated at both the Federal and State levels occur on the Lynn Harbor fabrication site. Based on the COE definition of wetlands, onsite wetlands include relatively small isolated areas located landward of the bulkhead (Figure 62). Most likely, the necessary salinity which maintains the growth of such estuarine plants as spike grass, orach, and reed grass originates from wave spray during storms. These wetlands are approximately 3 acres in size. The importance of these stands of wetland vegetation is very limited given the daily traffic around and through them.

According to the wetland classification plan adopted by the U.S. Fish and Wildlife Service (FWS), Federally-regulated wetlands onsite would likely be classified as palustrine and estuarine emergent communities. The most abundant plant species in these portions of the site consist of reed grass and spike grass. A variety of upland plant species, however, also occur in these areas. Such species include seaside goldenrod, tansy, aster, ragweed, clover, and barnyard grass, among others. A more detailed listing of plant species for the Lynn Fabrication site wetlands is presented in Appendix 7.

Wetlands regulated under the Massachusetts Wetlands Protection Act (WPA) are more extensive. Based on the State definition of coastal wetlands, wetlands onsite include lands beneath Lynn Harbor and the Saugus River, as well as those areas

landward to the limit of the 100-year floodplain. Although portions of the area landward of the high tide line and seaward of the 100-year floodplain consist of developed sites and areas dominated by vegetation typically adopted to upland locations, these areas are, nonetheless, considered wetlands under the WPA. The 1976 HUD flood maps indicate that approximately 6 acres of the site are within the 100 year floodplain (see Figure 62).

4.17.4 Vegetation

In addition to wetlands, vegetation at the Lynn Harbor Fabrication site primarily consists of successional lands (vegetated areas subject to eventual community replacement). Throughout the site, however, areas of exposed soil are also common. Dominant plant species in successional areas typically include such woody and herbaceous species as quaking aspen, bayberry, dewberry, goldenrod, lamb's-quarters, cocklebur, and clover. A more detailed listing of plant species is also presented in Appendix 7.

4.17.5 Wildlife

The wildlife habitat potential of the site is relatively limited. This is due to the disturbed nature of the area and the proximity of developed lands. Characteristic wildlife species of the Lynn Harbor fabrication site, including Lynn Harbor, include Norway rats, eastern cottontail rabbits, herring gulls, greater black-backed gulls, double-crested cormorants, black ducks, greater and lesser scaup, house sparrows, robins, red-winged blackbirds, and eastern garter snakes, among others. A listing of project area wildlife species is also presented in Appendix 7.

4.17.6 Endangered and Threatened Species

Table 17 (see Section 3.9.3) provides a list of Federally-listed endangered and threatened species for Massachusetts. Under State regulations, only the Federally-listed species and the small whorled pogonia (a flowering plant) are protected as threatened or endangered species. According to the Massachusetts Division of Fisheries and Wildlife, the whitlow-wort (a flowering plant) is also being considered for listing at the State level.

The occurrence of any of these species at the fabrication site is highly unlikely according to the U.S. Fish and Wildlife Service.

A variety of vegetative and wildlife species has been identified as uncommon in Massachusetts. None of these species, was recorded during field investigations. Additionally, based on their habitat requirements, none is likely to occur at the site.

4.17.7 Impacts

Discussions have taken place with COE, EPA, Fish and Wildlife Service (FWS), and National Marine Fisheries Service (NMFS) on the potential use of Lynn Harbor for this purpose. FWS and NMFS expressed concern about the potential effects of the construction of the dry docks to the shallow water and intertidal habitat used by fish and waterfowl and impacts to the mussel beds.

Conversion of the present Lynn Harbor terrestrial site to a concrete tube fabrication area could result in permanent loss of wetlands and terrestrial vegetation and wildlife, and marine resources. Inasmuch as the existing terrestrial parts of the site are highly disturbed with small and discontinuous stands of wetland and upland vegetation which has grown over the site's previous disturbance, the loss is not considered to represent an impact to significant terrestrial or wetland resources. It is not yet known, however, how much of the land area would be used for fabrication, should the Lynn site be selected in design.

Construction of the dry docks

will require the use of approximately 75 acres (10 percent of Lynn Harbor) of shallow water/intertidal habitat (approximately 21 acres of which are considered intertidal blue mussel flats). Construction of the dry docks will require dredging of approximately 5 million cubic yards of marine sediment. Structural fill requirements for the dry dock berms are less than 1 million cubic yards, leaving a surplus of 4 million cubic yards. Based on subsurface conditions at the new wastewater treatment facility now under construction near the proposed dry dock area, it is expected that clays underlie the surface sands and silts. Disposal of the excess excavate would take place at the Massachusetts Bay Foul Area. All excavation of sediments will take place with drag line and/or clamshell bucket dredges. Since surrounding sediments have been tested and found uncontaminated and through bioassay analyses have also been found to be acceptable for open water disposal (see Section 4.17.1), no unacceptable toxicological impacts are anticipated from dredging or disposal. Some finfish will be destroyed during dredging.

Of the seven alternative configurations which were considered, the proposed dry dock configuration provides the least impact to marine resources and is most economical and workable.

The temporary loss of marine habitat will last for the approximate three years required for tunnel section contruction. After fabrication is complete, the dry docks will be destroyed. Recolonization of the dry dock area will proceed rather rapidly as is the case with most dredge material disposal sites. Larvae of worms and other marine life settling in the following growing season will enhance the repopulation of the benthic community. Ultimate (steady state) populations are difficult to predict. It is expected, however, that near full regrowth of benthic and fish populations will be found within five years. Shellfish habitat removed for the dry docks will be permanently lost since after the dry dock berms are removed, there will remain a channel and possible mooring area approximately 30 feet in depth.

Permits required for construction of the dry docks derive from Sections 9, 10, and 11 of the Rivers and Harbors Act of 1899; Sections 404 and 401 of the Clean Water Act; and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972.

Two measures to minimize impact during construction (and removal of dry docks) include the restriction of dredging during flounder spawning season (February 1 to May 15) and the deployment of silt curtains downstream (seaward) of operating dredges.

Should project timing coincide with landfill capping at Lynn, some of the marine clays could be used at either of the two nearby landfills.

Section 4(f) of the Department of Transportation Act of 1966 prohibits use of land from a significant publicly-owned park, recreation area, or wildlife or waterfowl refuge or any significant historic site unless it can be shown that (1) there are no feasible and prudent alternatives to the use of the land from the property; and (2) the proposed action includes all possible planning to minimize harm to the property resulting from such use.

5.1 PARKLANDS

There are two recreation areas affected or potentially affected by one or more of the build alternatives.

5.1.1 East Boston Memorial Stadium

Description

This recreation area totals 17.67 acres. It is located between the inbound and outbound airport access roads east of Route 1A, and includes an additional parcel of 50,400 square feet located south of the inbound airport roadway (see Figure 63). The latter parcel has been augmented by approximately 26,000 square feet of adjacent land leased from Massport.

The facilities include a softball field, baseball field and 4900-seat stadium, all of which have floodlighting for evening use. The stadium building contains offices, shower rooms, a first aid station, locker facilities and a maintenance depot for the owner, the Boston Parks and Recreation Department. A track, basketball courts and a tot lot with wading pool, swings, slide and jungle gym are also provided. Tennis courts lie at the eastern end of the field.

The parcel south of the inbound roadway has two street hockey courts demarcated, but the land is used for commercial parking.

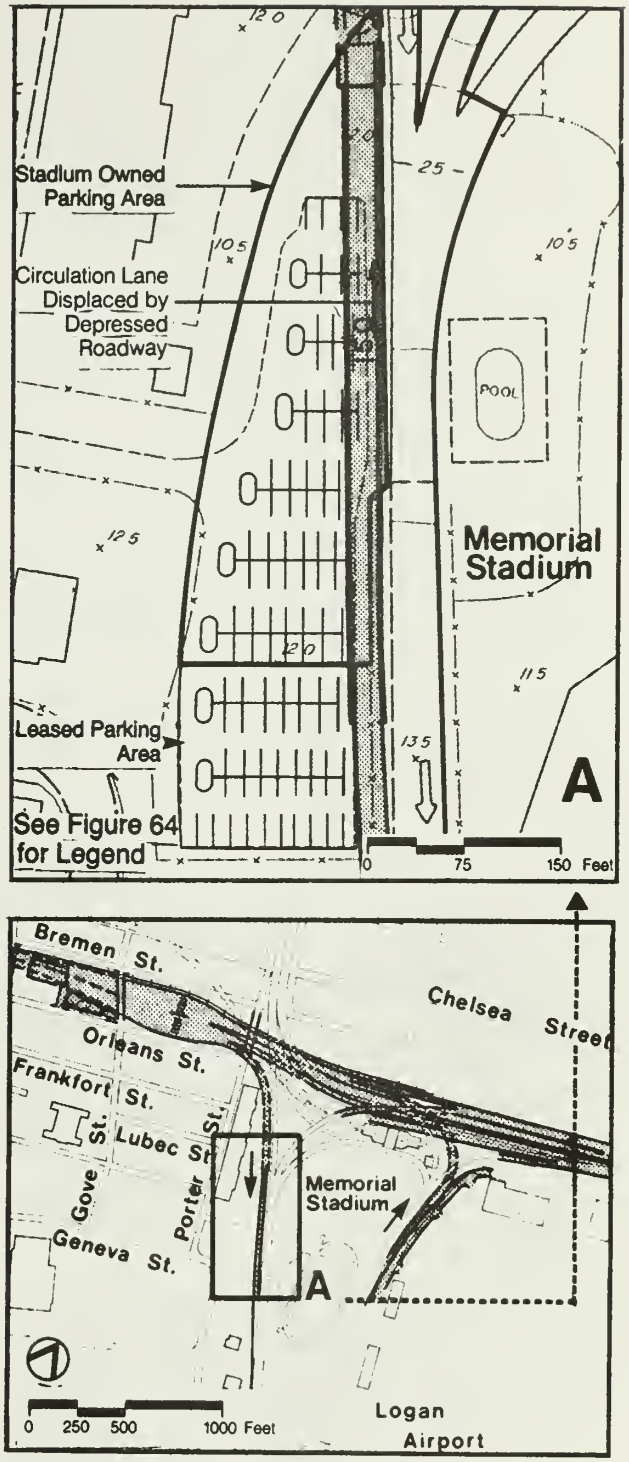


Figure 63
East Boston — Memorial Stadium — Takings Under Alternatives 2&4

Separate Scales for each Diagram

EIS/EIR for I-90, The Third Harbor Tunnel

All facilities in the stadium complex are heavily used. It is the only East Boston park with a single-use football field, and one of only four East Boston parks with flood-lights. The three other floodlit parks are located throughout East Boston and serve different neighbor-hood groups.

In addition, the stadium playfields are a city-wide and regional resource. The football field is a home field for East Boston High School games and practice. It is also used by 8 Boston Park League football teams, and by 1,200 boys in the East Boston Youth Athletic Association football program. The football field is used for competition by two state-wide soccer associations which play over four games per week in season. It is also used for a city-wide summer recreation program for handicapped and emotionally disturbed children which serves over 300 daily.

The baseball and softball facilities are used as home fields for East Boston High School, by 16 baseball and 22 softball teams in the Boston Park League, and by the East Boston Girls' Softball League. Most of the airlines at Logan Airport have a team in the Massport League which has softball games two nights per week. In addition, the East Boston Little League maintains a separate baseball diamond within the stadium complex.

In spite of limited play facilities, the tot lot and wading pool area are heavily used. East Boston Social Centers, Inc. uses the area as part of its summer Day Care Center program, which serves hundreds of children each day.

The Boston Parks and Recreation Department recently entered into an agreement with Park & Fly, Inc., whereby Park & Fly maintains the stadium and grounds in exchange for the exclusive right to use the 140-space parking area south of the inbound roadway. The parking area is now closed to the public and cannot be used as a point of access into the park.

Present access for both pedestrians and vehicles is at the southwest corner of the park, on a roadway which passes under the existing inbound airport ramps and runs along the western edge of the park. According to the 1954 deed to the parkland, the Boston Parks and Recreation Department easement over this roadway is for pedestrians and service vehicles only, although this restriction is not enforced. The 1954 deed provides an easement for public vehicular access from Porter Street to the parcel south of the airport road and a pedestrian easement between this parcel and the main field.

The recreation area was transferred to the City of Boston in 1954 by the Commonwealth of Massachu-setts in exchange for the City-owned Amarena Playground, acquired by the Commonwealth for airport expansion. Approximately one third of the stadium's parking area is located on a contiguous parcel leased for an indefinite term from Massport. The Boston Parks and Recreation Department has also been given easements across the land under the highway and MBTA ramps. These easements differ by parcel, but basically are for laying and maintaining utility lines and for providing pedestrian and service vehicle access to the park.

Although the facilities themselves do not possess any unusual characteristics, the fact that this park is a replacement for parkland previously taken for airport expansion makes any encroachment on this park of concern to the community. According to the National Park Service, no Section 6(f) funds have been used on this property.

Location and Amount of Land To Be Used

In Alternatives 2 and 4, the connection from the tunnel and toll plaza area into the airport will encroach 20 feet into the edge of the

parking lot immediately south of the inbound airport roadway (see Figure 63). The area taken will be approximately 14,000 square feet, and will displace a parking lot circulation lane, which, if relocated parallel to the proposed roadway, will in turn displace 13 parking spaces. It should be reemphasized that this portion of the park is currently leased by the owner to a private park/fly company and is not available for use by the public for its intended purpose. Pedestrian access between this parking area and the main stadium grounds will not be precluded by the tunnel project.

In Alternatives 3 and 5, the park will be affected in four locations (see Figure 64): (1) The tunnel will run under the northeast corner of the park, about 10 feet inside the fence line, but outside of the tennis courts. An area of approximately 3400 square feet will be disrupted during the cut-and-cover construction of this portion of the tunnel but will then be restored to its original condition. (2) The airport service road will run at a small angle along the western edge of the park up to 25 feet inside the fence line, taking approximately 6000 square feet of grass-covered area. An additional 6000 square feet of paved and grassed area will be disrupted during construction of a short tunnel segment under the park access and then returned to park use. Pedestrian and vehicular access will be maintained during construction. The service road will be 40 feet from the softball fields right field foul line and 12 feet from the warm-up bench. Two light standards and a small portable bleacher seating unit will have to be relocated. Three mature red oak trees and a mature basswood tree ranging from 12-14 inches in diameter will be removed; these trees presently help to screen the field from adjacent elevated roadways. (3) The elevated roadway ramp from Route 1A to the tunnel will encroach 15 feet into the edge of the parking lot south of the inbound airport roadway, taking 7500 square feet of parking area (currently leased to Park & Fly, Inc). Thirteen parking spaces will be displaced by this roadway. Pedestrian access between this parking area and the main stadium grounds, however, will not be affected. This elevated ramp will also cross above a paved park parcel with vertical clearance of at least 15 feet; approximately 7000 square feet of air rights would be taken. (4) The airport service road connection into the tunnel will run 10 to 30 feet into the southern edge of the parking lot south of the inbound roadway, taking approximately 11,000 square feet of land on two parcels owned by Boston Parks and Recreation Department, and displacing 30 parking spaces, 24 of which are on the parcel leased from Massport. Vehicular access from Porter Street into the parking lot will not be affected.

Other Impacts

Air quality at East Boston Memorial Stadium will be substantially improved by all build alternatives relative to the No-Build Alternative (see Section 4.6). The build alternatives do not differ significantly in the degree of improvement. Overall noise levels at the park will not be significantly increased by any build alternative and FHWA criteria for project noise mitigation are not exceeded. (See Section 4.7.)

Measures to Minimize Impacts

For Alternatives 2 and 4, the circulation pattern of the affected stadium parking area can be modified to reduce the loss of parking from 13 spaces to 6, at the expense of less adequate circulation. This would be accomplished by eliminating the circulation lane, making the parking bays accessible from one circulation lane only.

The parking lot takings in Alternatives 3 and 5 can be mitigated to some extent by modifying parking lot circulation as described above under Alternatives 2 and 4, in this case reducing the number of spaces

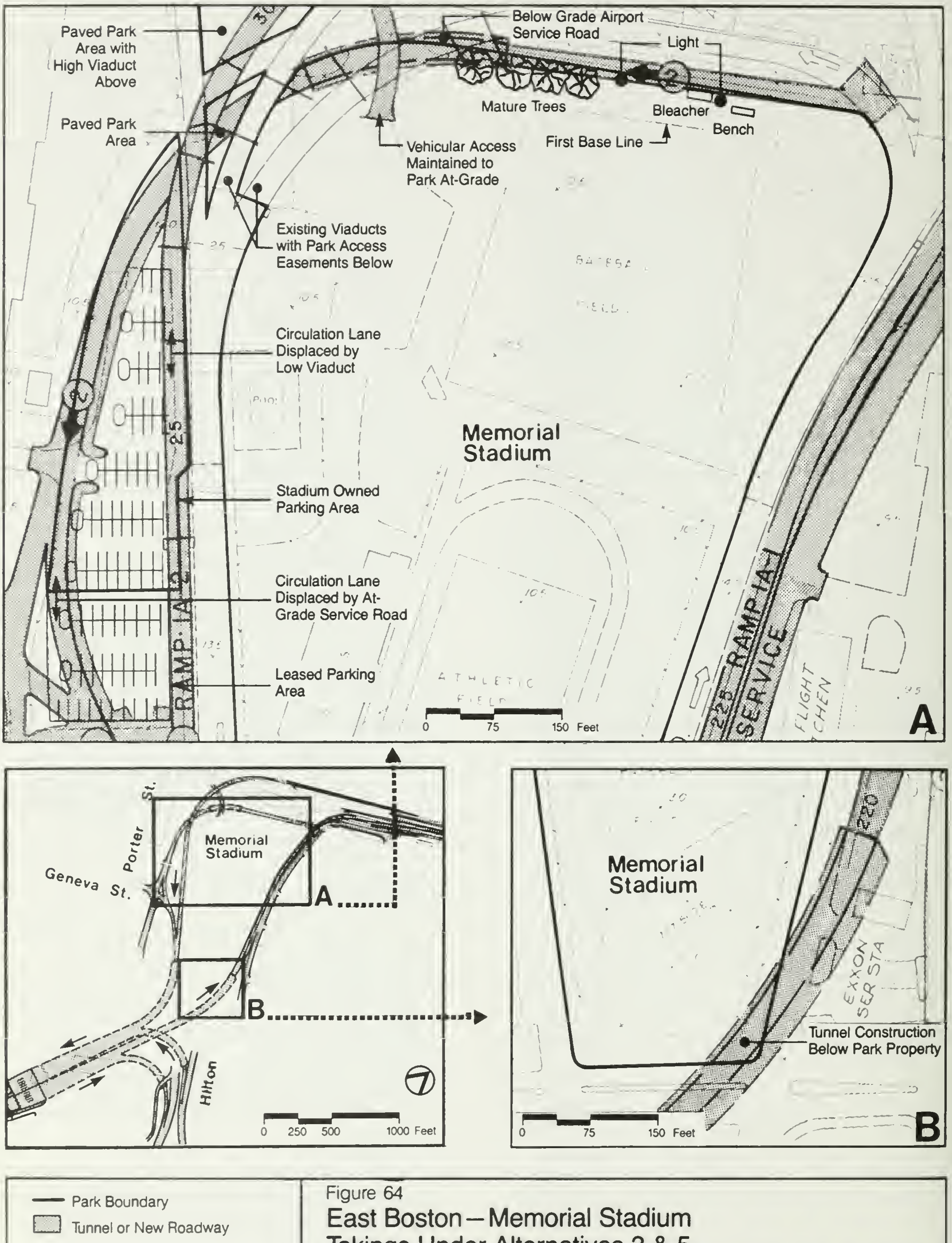


Figure 64

East Boston — Memorial Stadium Takings Under Alternatives 3 & 5

Separate Scales for each Diagram

EIS/EIR for I-90, The Third Harbor Tunnel

taken from 43 to 36.

Removal of trees caused by the airport service road connector in Alternatives 3 and 5 can be mitigated by replacement with mature trees within the new fence line; this measure will help recreate the current visual character of the park following construction. The service road connector will be constructed in a tunnel segment below the entrance to the park; this design is specifically intended as a mitigating measure, allowing unimpeded pedestrian and vehicular access to the facility.

Alternatives Which Would Avoid the Section 4(f) Property

Alternatives which would avoid the 4(f) property were examined in relation to the two basic project alignments in the East Boston railroad right-of-way (Alternatives 2 and 4) and through Logan Airport via Jeffries Cove (Alternatives 3 and 5). Prior investigations (Massachusetts Turnpike Authority 1968, Boston Transportation Planning Review 1972, and Corridor Planning Study 1980) have determined that no other corridors exist which would provide cross-harbor connectivity (Interstate Route 90 to Route 1A) without major residential takings in East Boston. The following discussion, therefore, focuses on potential variations in these basic alignments to avoid or minimize encroachment on the 4(f) property.

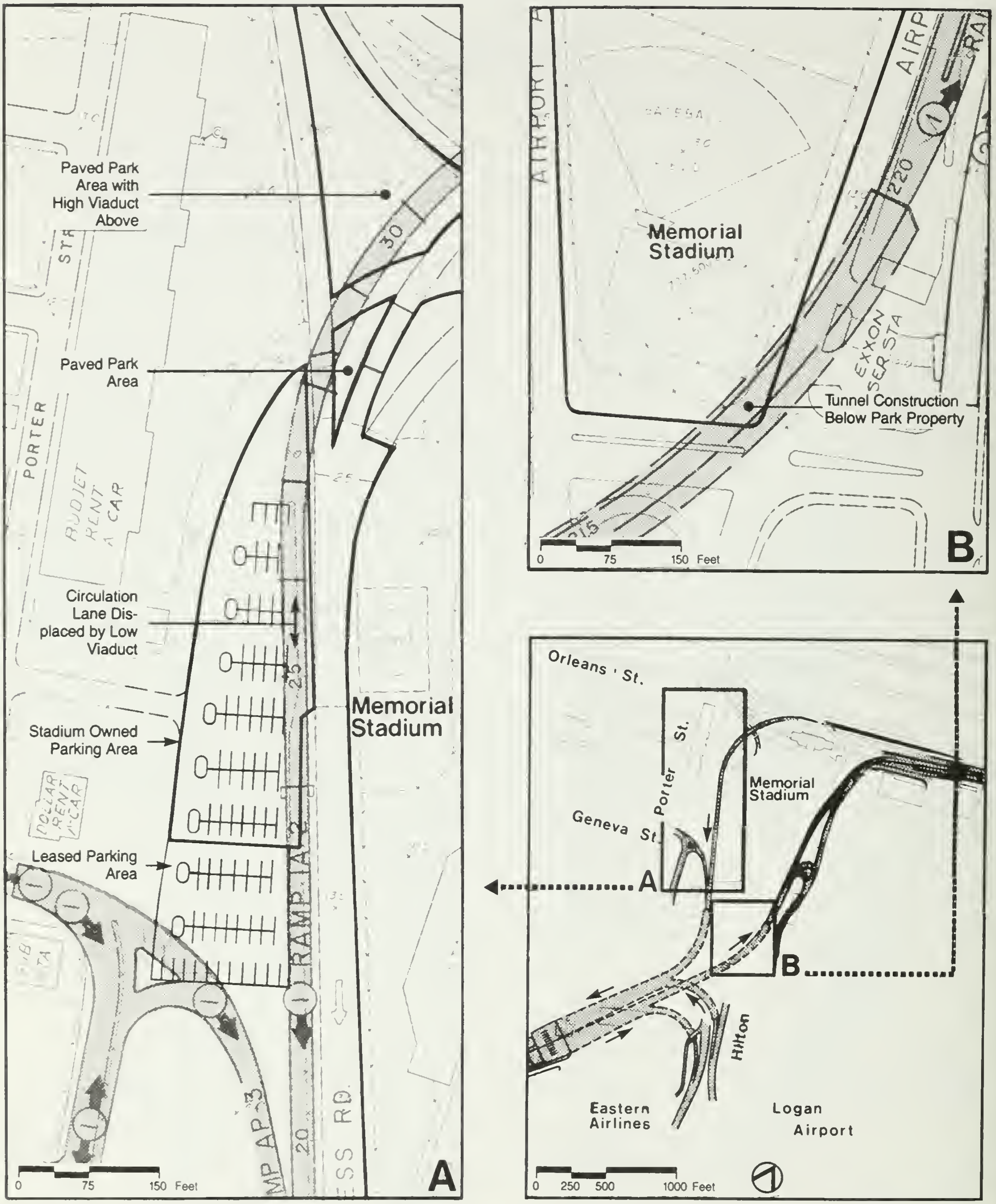
For Alternatives 2 and 4, avoidance of the 4(f) property would require the airport access connection to be located further south, requiring takings of two four-story industrial buildings on Porter and Orleans Streets. As this connector roadway enters Logan Airport it would require relocation of the Massport electric substation and taking of the Dollar Car Rental building, Emery Air Freight building, Eastern Airlines Air Freight building and Eastern Airlines Fuel Farm. (Alignments further to the south would result in substantial residential takings and airport takings.) The connector roadway would either follow a reverse-curve alignment or merge with the inbound airport roadway at a point too far east to allow adequate weaving distances with access roadways for the airport garage and terminals; there would also be conflicts with local circulation in the airport service area traversed by the connector. Other alternate alignments would have unacceptable geometrics and greater property takings.

For Alternatives 3 and 5, alternate alignments of the connector from Route 1A southbound to the tunnel to avoid the 4(f) land would require relocation of the airport electrical substation and takings of a four-story industrial building on Porter Street, the Dollar Car Rental building and Emery Air Freight building. To avoid all use of the 4(f) property, the tunnel alignment would have to be shifted to the east to avoid temporary taking of the northeast corner of the park, entailing a temporary taking of the Eastern Airlines Hangar apron. Finally, the proposed airport service road connector would require modification as described below.

Airport Service Road Connector Alternative

A two-way service road concept, outside of the stadium property, was studied as an alternative to the one-way airport service road loop connection through the west end of the athletic field and its parking area. The two-way alternative would completely avoid encroachment in the western edge of the parkland and reduce (but not eliminate) takings in the parking lot south of the inbound airport roadway. This concept is presented on Figure 65. The following analysis provides a detailed comparison of the alternative two-way service road concept and the proposed one-way airport service road connector road.

4(f) Land Used. The two-way service road would use no 4(f) land, eliminating two of the four takings in the park, while the one-way loop road



Park Boundary

Tunnel or New Roadway

Figure 65

East Boston — Memorial Stadium Alternative to Minimize Section 4F Involvement

Separate Scales for Each Diagram

EIS/EIR for I-90, The Third Harbor Tunnel

permanently takes approximately 6000 square feet of the athletic field, including four mature trees, and will displace 30 stadium parking spaces. However, the other modifications in alignments described above would also be required to avoid all encroachment on 4(f) land.

Takings and relocation impacts outside the park area would be substantially greater with the two-way service road concept than with the one-way loop. The two-way option would require the taking of the United Airlines Flight Kitchen, valued at approximately $540,000, and the Williams Annex, valued at approximately $410,000. The United Airlines Flight Kitchen might be difficult to relocate owing to the high cost of constructing a new kitchen, estimated at $1.5 million to $3 million, and the lack of existing space at the airport adaptable for kitchen facilities; the facility currently employs approximately 70 people. The Williams Annex tenants would probably relocate to existing space at the airport, possibly to Bird Island Flats. The one-way connector loop will take a very small portion of the Budget Rent-A-Car site and a portion of the Dollar Rent-A-Car site, valued at approximately $30,000. Budget Rent-A-Car would probably remain at its current site; Dollar Rent-A-Car might have to relocate or lease additional land, which is expected to be available.

Construction cost of the one-way service loop road is approximately $6 million higher than that for the two-way alternative.

Geometry and design speeds are comparable for the one-way loop road and the two-way alternative.

Traffic service characteristics are significantly inferior with the two-way alternative. The coupled intersections of the two-way service road with the airport access-egress roads would function at level of service E. An additional "T" intersection would be created where tunnel traffic would join airport traffic at-grade on the two-way service road, reducing service on the system. Poor sight distance to stop signs or traffic signals at this intersection would pose a safety hazard, and queues from the intersection could obstruct northbound traffic from the tunnel to Route 1A. The two-way service road would be compatible with one of the roadway options presented in the 1981 Logan Airport Master Plan, but would not be compatible with the option preferred by the Massport Engineering Department.

With the one-way service road, the intersection with the airport access-egress roads will function at level of service D. Tunnel connections with the one-way service road will require no intersections and will cause no queuing conflicts or safety hazards. This connection is compatible with Logan Airport Master Plan roadway options preferred by the Massport Engineering Department.

In summary, although the two-way alternative reduces the Section 4(f) property involvement, compared to the one-way service loop road included in Alternatives 3 and 5, it involves adverse safety and queueing problems, inferior level of service, the displacement of the United Airlines Flight Kitchen and other takings, and other factors described above.

5.1.2 Proposed Bird Island Flats Park

Description

The proposed park will be located along the edge of Jeffries Cove (see Figure 66), from the southwest corner of the Bird Island Flats mixed-use development area northward to a point abutting the property currently leased by Massport to Van Duesen Aircraft Supplies of New England, Inc. The park will be approximately 2800 feet long with a minimum width of 20 feet measured from the current mean high tide line. The park land is owned by the Massachusetts Port Authority.

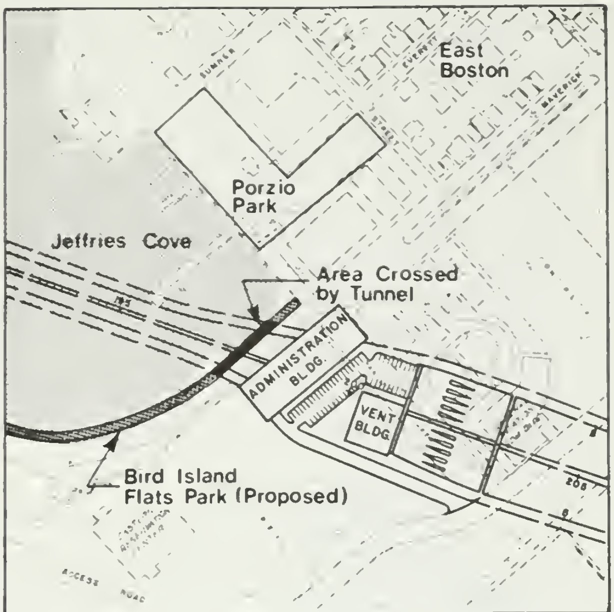


Figure 66
Bird Island Flats Park (proposed)
Takings Under Alternatives 3 & 5

EIS/EIR for I-90, The Third Harbor Tunnel

Its construction is planned to coincide with the three-stage construction of the Bird Island Flats mixed-use development, and is required by legal agreement to be completed no later than June 30, 1987 (see below).

The property will be affected by Alternatives 3 and 5 if the park is constructed prior to the tunnel project. Otherwise, there will be no Section 4(f) involvement.

The park will be built on existing filled land, with an adjacent seawall extending a third of its length and a rip-rap bank along the remaining shoreline. It will be landscaped for passive recreation with a "walk to the sea," and will provide distinctive views of Boston Harbor and downtown Boston. The park will also provide opportunities for jogging, cycling, roller skating, fishing, and picnicking. Proposed designs include displays about Massport and the history and ecology of Boston Harbor.

The park, when completed, will be open to the public. Along with nearby Porzio Park, it will help to maintain Jeffries Cove as a scenic waterfront recreation area. The two areas are mutually reinforcing in this respect.

Pedestrian and emergency vehicle access from Maverick Street will be the only off-airport access to the park. Access from proposed adjacent airport buildings will also be provided, but is intended primarily for tenants of these buildings. A ferry boat landing at the proposed park with shuttle bus access into the airport is also under consideration by Massport.

There are no restrictive land clauses affecting title to this park; however, the proposed Bird Island Flats Park was created as the result of a court agreement between Airport Impact Relief, Inc. and the Massachusetts Port Authority, and a development time schedule is included in that agreement. The park is to be developed in order to help mitigate the impacts of the Bird Island Flats development on the Jeffries Point neighborhood. It is the result of agency/community negotiations; any encroachment on the park may therefore be of particular concern to the community.

Location and Amount of Land To Be Used

In Alternatives 3 and 5, the tunnel will cross under the northern end of the proposed park (see Figure 66). A 3200 square foot (approximately) construction easement will be required; construction is estimated to take two to four months. During the two to four month construction period, access to and from the park from Porzio Park and Maverick Street, the primary public access from the neighborhood, only will be discontinued. Upon completion of this section of the tunnel, the park would be restored to its original condition.

Other Impacts

Air quality at Bird Island Flats Park (and Porzio Park) will be improved by all build alternatives; however, there may be construction-period air quality impacts. Total noise levels will not increase perceptibly relative to the No-Build Alternative, based on modelling for the adjacent Porzio Park, and project noise will not exceed applicable FHWA criteria for noise mitigation. Following replacement of the disrupted park area, there will be no visual impact.

Measures to Minimize Impacts

Construction will be staged to minimize the period of disruption to two to four months, as indicated above. It may also be possible, with Massport's cooperation, to provide near direct alternative access through airport property.

Alternatives Which Would Avoid the Section 4(f) Property

Alternatives 2 and 4 as well as the No-Build Alternative avoid this potential 4(f) property completely. With Alternatives 3 or 5, however, highway geometric considerations make it impossible to avoid the proposed Bird Island Flats Park without potential encroachment in the Jeffries Point residential neighborhood.

Shifting the tunnel alignment to the west to avoid the park would cause encroachment on nearby existing Porzio Park; if the tunnel were realigned further to the west it would traverse a dense residential neighborhood directly affecting approximately 150 residential dwelling units and the Bethlehem Shipyard. If realigned to the east of the 4(f) property, highway geometrics would become undesirable and major airport takings in the Bird Island Flats air cargo area and Eastern Airlines passenger terminal would result.

5.2 ARCHAEOLOGICAL SITES

The locations of significant archaeological sites will be made following a Phase II archaeological survey which will be undertaken following publication of the Draft Environmental Impact Statement/ Report. Any 4(f) impacts will be documented in the Final EIS/EIR.

5.3. HISTORIC RESOURCES

Of the resources discussed previously in Sections 3.10 and 4.13, which were either listed on the National Register of Historic Places or potentially eligible for the Register, only the Fort Point Channel district will be directly affected by the proposed construction. For a discussion of project impacts on historic and archaeological resources, see Section 4.13; for a more detailed discussion of the Fort Point Channel and other resources, in terms of their historic significance and characteristics, refer to the "Historic Resources" inventory report.

5.3.1 Fort Point Channel Potential National Register District

Description

The Fort Point Channel area, including the Channel itself, the bridges over it, and the wharves, warehouses and transportation facilities on either side of it, comprise a physical record of the complex transportation developments which accompanied the rapid industrial expansion of Boston in the late nineteenth and early twentieth centuries. The Channel forms a symbolic vestige of the original Shawmut Peninsula on which Boston was located. The Fort Point Channel area is potentially eligible for the National Register based on consultations with the Massachusetts Historical Commission and the Boston Landmarks Commission. According to the National Park Service, there have

been no Section 6(f) funds expended on this District.

The District includes the following contributing elements.

The Fort Point Channel (ca. 1890's). This historic waterway, bordered by granite bulkheads, was created as part of the late nineteenth century industrial/transportation development of South Boston. It is owned by the Commonwealth of Massachusetts.

The Northern Avenue Bridge. Built in 1908, this is a pivoting lift swing bridge determined to be eligible for the National Register in 1980. It is owned by the City of Boston. Replacement of this bridge by the Massachusetts Department of Public Works on behalf of the City of Boston is planned as a separate future project under all five alternatives. The existing bridge will be placed permanently in its open position; the existing bridge's center span will be retained and a new Northern Avenue Bridge constructed approximately 200 feet south of the existing bridge.

Congress Street Bridge. Built in 1930, this single-leaf bascule bridge represents the final period of development of the Channel and warehouse subdistrict. It is owned by the City of Boston.

Summer Street Bridge. Built in 1898, it is a retractable bridge of a design developed in Boston. Although inoperable, it is one of only two such bridges remaining in the city. It is owned by the City of Boston.

Old Colony Railroad Bridge. This Scherzer rolling lift bridge, built in 1899, historically is perhaps the most important of South Boston's many bridges. It is owned by the Trustees of the Penn Central Railroad.

Boston Wharf Co. Warehouse District. Built between 1880 and 1930, this unified district of late nineteenth and early twentieth century industrial buildings was built by the Boston Wharf Co. It is privately-owned, except for city streets.

Factory Buildings Trust/A Street Industrial Buildings. These buildings were constructed in the 1890's to 1930's as an extension of the Boston Wharf Co. industrial development. Except for the city-owned streets, it is privately-owned.

Impacts on the Fort Point Channel District

Long-Term Impacts. All build alternatives will have the permanent impacts discussed below: (1) The western bulkhead line will be moved approximately 100 to 115 feet towards the east, into the existing Channel, reducing the Channel's width of open water by approximately 22 to 50 percent, depending on location. (2) Two ventilation buildings will be built to serve the proposed tunnel. One building will be at the northwestern edge of the Channel near Northern Avenue and the other near the Massachusetts Turnpike/Central Artery interchange; the former building will affect the view of Boston Harbor from the Channel's bridges and western edge. (3) In the Russia Wharf area, direct water access to the Channel will be affected by relocated Dorchester Avenue. South of Summer Street the existing Dorchester Avenue is owned by the U.S. Postal Service and is closed to traffic and pedestrians. Pedestrian access to the waters edge will be reestablished along the full length of the Channel under any of the build alternatives. (4) Vehicular traffic, which has traditionally moved across the Channel, will also move parallel to it; this will change the acoustical characteristics of the District (see Section 4.7). (5) With Alternatives 2 and 3, a viaduct ramp at Summer Street will introduce a new crossing of the Channel. As viewed from Summer Street (looking south), this ramp will reduce the visual width and length of the Channel; the curvilinear form of this ramp differs from the linear forms of the historic bridges. With Alternatives 4 and 5, two viaduct

ramps will be introduced at Summer Street, further reducing the Channel's width and length of open water south of Summer Street and masking views from the Boston side of the Channel of historic buildings in the Boston Wharf and A Street areas.

All build alternatives will require removal of the western spans of the Congress Street and Summer Street Bridges and reconstruction as part of the relocated Dorchester Avenue/tunnel structure. The lift span and counterweight of the Congress Street Bridge will remain intact, but the diagonal trusses which carry the movable spans of the Summer Street Bridge will be removed. Relocated Dorchester Avenue (and the relocated bulkhead line) will shorten these bridges by approximately one-fourth and change their symmetry and visual character on the Boston side; it will also visually separate them from streets and wharves to which they are historically connected. The build alternatives will remove the Old Colony Railroad Bridge and fill in the portion of the Channel lying beneath it. While this bridge also contributes to the historic technological context of historic South Station, the South Station Transportation Center Project will result in substantial new building construction between South Station and the bridge. This will reduce the visual connection between the station and the bridge, and render the adverse impact of the bridge's alteration less noticeable.

Short-Term Impacts. During construction, all build alternatives will affect both vehicular and current and future marine access to the Fort Point Channel area as a result of successive closings or reductions in width of the bridges, and the use of temporary bridge structures; the placement of steel sheeting in the Channel; and the presence of barges and construction equipment. The construction activities themselves may also affect the area and its use as a result of construction-related noise, dust and vibration. Activities at the Boston Tea Party Ship Museum will be adversely affected during construction in this area, particularly the on-deck presentations of the historic Tea Party.

Alternatives Which Would Avoid the Section 4(f) Property

Alternative tunnel alignments east and west of the Channel were considered and rejected in the Corridor Planning Study owing to unacceptable horizontal and vertical geometry, additional property takings and displacements, and costs (see Section 2.7). Because of the need to tie into the existing Massachusetts Turnpike interchange with the Central Artery, the Fort Point Channel District can not be completely avoided. Alignments easterly or westerly would affect other National Register Historic Districts or potential districts in downtown Boston or South Boston, including areas such as Dewey Square and Rowe's Wharf.

Measures to Minimize Impacts

Construction period impacts can be mitigated to some extent by specifications which require: (1) construction methods and equipment that minimize noise and vibration; (2) controls on dust (e.g., limitations on stockpile locations and covering of stockpiles); and (3) limitations on use of roadways in the district by construction-related traffic as much as possible.

The reduction in the water surface of Fort Point Channel cannot be mitigated without substantially altering the project and affecting other historic properties. Originally, ramp access to the proposed tunnel was proposed at Northern Avenue. As discussed previously in Section 2.7, ramps at the Northern Avenue location severely affected the adjacent Rowes and Fosters Wharves - themselves historic such that the Summer Street location was considered. Thus, the current design is an attempt to mitigate the potential environmental impacts on these historical resources. The impact on

the western bulkhead can be mitigated to some extent by the use of granite facing blocks cut to simulate the existing bulkhead in both size and color. The Summer Street interchange ramp(s) will be designed to reduce their visual dimensions by using the longest feasible spans while minimizing depth of structure. Pedestrian access to the water's edge and future marinas will be maintained and enhanced as discussed previously.

Changes to the Congress and Summer Street Bridges cannot be avoided, but the existing structures will be carefully documented (by photography and drawings) prior to modification. Portions of the diagonal trusses of the Summer Street Bridge may be retained. Details such as the Congress Street lanterns and railings can be saved and reused as decorative elements in the pedestrian improvements along the relocated Channel edge.

It may be possible to mitigate impacts on the Old Colony Railroad Bridge by rebuilding the structure at-grade following construction.

Facade treatment of the ventilation structure or joint uses appropriate to the location may also help to mitigate its visual impacts on the Channel District.

5.4 CONSULTATION

Consultation has been initiated through meetings and discussions with the following Federal, State and local agencies:

Boston Department of Environment - ongoing consultation through the City's representation on the Steering Committee; meeting held January 22, 1982.

Boston Parks and Recreation Department - ongoing consultation through the City's representation on the Steering Committee; meeting with staff on April 22, 1982.

Boston Landmarks Commission - meetings held July 6, 1982 and December 17, 1982; additional consultation through the City's representation on the Steering Committee.

Massachusetts Historical Commission (State Historic Preservation Officer) - meetings held on July 6, 1982 (Archaeology) and December 17, 1982; correspondence from SHPO on June 29, 1982 and September 23, 1982.

Massachusetts Executive Office of Environmental Affairs (Outdoor Recreation) - ongoing consultation through representation on the Interagency Committee.

U.S. Department of Housing and Urban Development - correspondence from HUD on September 3, 1982.

U.S. Department of the Interior, National Park Service - technical assistance review and comments received, December 1982.

This consultation has resulted in the discussions regarding historical significance and impacts contained herein. It is expected that this consultation will continue throughout the EIS phase; results of additional consultation will be contained in the Final EIS/EIR.

6.1 GENERAL LEGAL AND FINANCIAL ISSUES

For each of the build alternatives, the Commonwealth of Massachusetts, through its designated agencies, proposes to finance, construct and operate a Third Harbor Tunnel as a toll facility. Because a new harbor crossing would constitute an extension of Interstate Route 90 (Massachusetts Turnpike) beyond its present terminus to Route 1A in East Boston, and because the Massachusetts Turnpike Authority (MTA) possesses toll facility experience and expertise, the Commonwealth has concluded that, for a build alternative, the MTA should proceed with financing and developing the Third Harbor Tunnel through issuance of tunnel revenue bonds. The additional tunnel would be operated as an integrated system with the existing Callahan and Sumner Tunnels. The construction, financing, and operation of the Third Harbor Tunnel in this manner will require the enactment of enabling legislation by the Commonwealth.

A legal impediment to the MTA's or any other public agency's decision to implement construction and operation of a Third Harbor Tunnel is the prospective breach of the "no competition" clauses contained in the Enabling Act and Trust Agreement relating to the existing Sumner and Callahan Tunnels. The Enabling Act (Chapter 598, Acts of 1958) provides that any public entity other than the MTA is prohibited from constructing or operating any vehicular bridge, tunnel, or ferry within a distance of one-half mile upstream or one mile downstream from the existing tunnels. Additionally, in the Trust Agreement securing the existing tunnel revenue bonds, the MTA is covenanted to forego its rights to construct or operate such a crossing so long as any bonds issued thereunder remain outstanding. This "no competition" provision was intended to facilitate and protect payments to bondholders of the Sumner and Callahan Tunnels, which could be jeopardized by the existence of a new facility in close proximity which would divert traffic (revenue tolls) from the existing facilities to the new facility. Any attempt by the Massachusetts State Legislature to amend or repeal this "no competition" provision would therefore have to give due regard to the protection of the principal outstanding on the revenue bonds for the existing Sumner and Callahan Tunnels.

6.2 FEDERAL AID FOR TOLL FACILITY

As an extension of the easterly terminus of Interstate Route 90, the Third Harbor Tunnel will be eligible for federal aid under the Federal-Aid Highway Program for up to 90 percent of the construction-related costs. Federal participation in the construction of a toll facility and its approaches is conditioned upon compliance with the following provisions of Title 23 of the United States Code.

1. The tunnel and approaches to the tunnel must be publicly-owned and operated.

2. The Commonwealth must enter into an agreement with the United States Secretary of Transportation, providing that (a) all tunnel tolls, less the actual cost of operation and maintenance of the tunnel, shall be applied to the payment of the local share of the cost of construction of the tunnel, and (b) no tunnel tolls shall be charged after the local share shall have been repaid, and (c) the tunnel shall be operated as a free tunnel after the date of such repayment.

6.3 ESTIMATED TOLL SCHEDULE

In a unified and coordinated tunnel system comprising the existing tunnels and the new tunnel, it is imperative that the schedule of tolls to be charged and collected be the same for the three tunnels. For the purposes of this analysis the tolls to be

charged are for each direction.

The financial feasibility analysis is predicated on financing the Commonwealth's 10 percent share of the construction costs (including funds as may be necessary to redeem the then outstanding existing tunnel revenue bonds) through the sale of revenue bonds.

The bond issue evaluated is based on 40-year revenue bonds at an interest rate of 7 percent. It includes the Commonwealth's 10 percent share of construction costs, capitalized interest payments between the date of the bond issue and the time that revenues are available from the operation of the third tunnel, and financing and legal costs incurred in the preparation and sale of the bond issue.

The toll schedule required to finance the bond issue is dependent on the 1990 traffic forecasts (opening year) for the existing tunnels and the Third Harbor Tunnel; estimated costs of operation and maintenance of the three tunnels; provision for a replacement reserve fund to cover the costs of insurance, equipment and major non-recurring repairs; and debt service costs. In addition, investors in revenue bonds require, as a safety cushion, coverage above the level annual debt service requirements to retire the bonds by maturity.

Based upon the above criteria, and using present day costs, the following average toll has been estimated for each of the build alternatives:

Alternative 2 - $0.50 toll per vehicle
Alternative 3 - $0.55 toll per vehicle
Alternative 4 - $0.50 toll per vehicle
Alternative 5 - $0.55 toll per vehicle

6.4 FINANCIAL IMPLICATIONS FOR MYSTIC-TOBIN BRIDGE

Section 4.2 of this document indicates that operation of a Third Harbor Tunnel would result in a decrease of approximately 30 percent in Mystic-Tobin Bridge traffic and, presumably, revenues. It should be noted, however, the Mystic-Tobin Bridge is not a financially independent facility. Its revenues are merged with those of other Massport facilities in a complex financial structure. For example, during fiscal 1982, diversion of 30 percent of bridge revenues would have resulted in less than a two percent decrease in total Massport gross revenues. The 1990 financial impact of such a reduction would depend on the then outstanding financial requirements and Massport's policies regarding pricing structure.

AGENCIES, ORGANIZATIONS, AND PERSONS FROM WHOM COMMENTS ARE BEING REQUESTED

The following list of Federal, State, regional and local agencies and other parties have received copies of this DEIS and will be requested to comment on the content:

Federal:

- Environmental Protection Agency
- U.S. Department of Transportation - Secretarial Representative
- U.S. Department of Health and Human Services
- Federal Aviation Administration
- U.S. Department of the Interior
- National Marine Fisheries Services
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Public Health Service
- U.S. Department of Housing and Urban Development
- Urban Mass Transportation Administration
- Federal Emergency Management Agency
- Federal Railroad Administration
- Elected Officials:
  - Senator Edward M. Kennedy
  - Senator Paul E. Tsongas
  - Representative Thomas P. O'Neill, Jr.
  - Representative Edward J. Markey
  - Representative John J. Moakley

State:

- Office of the Governor
- Speaker Thomas McGee
- Central Transportation Planning Staff
- Office of Coastal Zone Management
- Department of Environmental Quality Engineering/Northeast Region
- Department of Environmental Quality Engineering/Division of Air Quality Control
- Executive Office of Communities and Development
- Executive Office of Economic Affairs
- Executive Office of Environmental Affairs
- Massachusetts Aeronautics Commission
- Metropolitan Area Planning Council
- Metropolitan District Commission
- Massachusetts Bay Transportation Authority
- Massachusetts Port Authority
- Executive Office of Public Safety
- Massachusetts Historical Commission
- Special Commission for the Development of Boston Harbor
- Senator Michael LoPresti, Jr.
- Senator William Owens
- Senator Joseph Walsh
- Representative Emanuel "Gus" Serra
- Senator William J. Bulger
- Representative Michael F. Flaherty
- Representative Salvatore DiMasi
- Representative Melvin H. King
- Representative Angelo Marotta
- Suffolk County Sheriff Dennis Kearney

Local:

- Office of the Mayor - Boston
- Office of the Mayor - Chelsea
- Office of the Mayor - Revere
- Office of the Mayor - Lynn
- Boston Conservation Commission
- Boston Redevelopment Authority
- Boston Traffic and Parking Department
- Boston Water and Sewer Commission
- Boston Public Works Department
- Boston Parks and Recreation Department
- Boston Economic Development and Industrial Commission
- Boston Department of the Environment
- Boston Landmarks Commission
- Boston Police Department
- Boston Fire Department

Boston City Clerk
Boston City Council
Boston Chamber of Commerce
Boston Neighborhood Development Agency
East Boston Chamber of Commerce

Private:

Eastern Airlines
The Gillette Co.
Camp, Dresser & McKee, Inc.
League of Women Voters
Coalition Against The Third Harbor Tunnel
League of American Wheelmen
Sierra Club
Association for Public Transportation, Inc.
Boston Society of Architects
Bay State Spray & Provincetown Steamship Co.
American Lung Association
Boston Harbor Association
Ellis Neighborhood Association
East Boston Jets Club
South Boston/Neighborhood House
North End Health Center
Museum Wharf Co.
East Boston Veterans Council
South Boston Citizens Association
Boston Aviation Council
Boston Waterfront Association
Sons of Italy
East Boston Fair Share
South End Committee on Transportation

Study Committees

Public input on the project was obtained by the use of three committees:

The Steering Committee provided continuous policy input. This Committee is comprised of the top official or his designee of the following agencies: Federal Highway Administration, Massachusetts Executive Office of Transportation and Construction, Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the City of Boston Mayor's Office. This committee has met monthly from January 1982 until present. The major direction of the study has been discussed at these meetings and major impacts have been brought out and discussed. This Committee has assured the coordination of the Federal, State and City governments throughout the DEIS process.

The Interagency Committee's emphasis was on the technical aspects of the study and gathering early inputs from the member agencies. Members of this Committee included the following:

Federal - Environmental Protection Agency, Federal Aviation Administration, Federal Highway Administration, Fish and Wildlife Services, National Marine Fisheries Services, Army Corps of Engineers, Coast Guard.

State - Central Transportation Planning Staff, Office of Coastal Zone Management, Department of Environmental Quality Engineering/Northeast Region, Department of Environmental Quality Engineering/Division of Air Quality Control, Executive Office of Communities and Development, Executive Office of Economic Affairs, Executive Office of Environmental Affairs, Executive Office of Transportation and Construction, Massachusetts Aeronautics Commission, Massachusetts Department of Public Works, Metropolitan Area Planning Council, Metropolitan District Commission, Massachusetts Bay Transportation Authority, Massachusetts Port Authority, Massachusetts Turnpike Authority.

City of Boston - Boston Redevelopment Authority, Boston Traffic and Parking Department, Boston Water and Sewer Commission, Department of Public Works. (The Interagency Committee also included two community representatives (one from East Boston and one from South Boston) that are also members of the Working Committee.)

The Interagency Committee has met monthly, beginning in January 1982 through publication of this DEIS (except March). At each meeting the agencies have been updated as to the DEIS progress, have been briefed on the alternatives as they were developed and refined, and have been presented information on existing conditions in the project area relating to air quality, water resources, archaeological resources, noise and vibration, traffic volumes, traffic accident history, land use/community inventory, and historical resources. Potential impacts of the project have also been presented as they were identified and quantified in the areas of urban design/joint development, traffic volume diversions, air quality, water quality, noise and vibration, relocation of businesses and construction staging.

In March 1982 when no meeting was held the progress summary was mailed to each agency. Copies of all newsletters produced for the study have also been distributed at these meetings. The many questions asked or concerns raised at these meetings were either directly answered or discussed further at a subsequent individual meeting with the particular agency. The following agencies were invited to attend the Interagency Committee meetings but did not attend: Massachusetts Department of Public Safety and City of Boston Economic Development and Industrial Commission.

The Working Committee provided close contact with community and neighborhood representatives for input on technical matters about the study. This Committee was formed from interested community groups and private individuals in the project area. The Committee has been open to all residents, community organizations and agency representatives. Starting in April 1982, the Working Committee has met at least once a month through the preparation of the document and has had presentations on all of the same subjects as at the Interagency Committee meetings. Additionally, discussions have focused on specific project details as they have related to local issues. Attendance at these meetings has averaged 35 people.

Additional meetings for continual coordination were held with many of the previously listed agencies. The following agencies not on the Interagency Committee were contacted for data on their facilities and/or their concerns relating to the project: Boston Educational Marine Exchange, Boston Harbor Associates, Boston Landmarks Commission, City of Boston Department of the Environment, Boston Conservation Commission, Boston Fire Department, Boston Neighborhood Development Agency, Boston Parks and Recreation Department, Boston Police Department, Federal Census Bureau, General Services Administration, Greater Boston Chamber of Commerce, Massachusetts Historical Commission, East Boston Land Use Advisory Council, and the East Boston Chamber of Commerce.

Also involved in coordination efforts for the project were the following private companies: Amtrak; Conrail; Boston & Maine Railroad; Eastern Airlines; Boston Edison Co.; Jung/Brannen Associates; The Gillette Co.; New England Aquarium; Camp Dresser & McKee, Inc.; America East Corporation; Bethlehem Steel Co. (East Boston); New England Medical Center; New England Telephone Co.; and Boston Gas Co.

Community Participation

An important part of the coordination efforts for this study have centered around the community participation phase.

During the preparation of this Draft Environmental Impact Statement/Report, community participation activities focused on reviewing study progress, data, and findings with the Working Committee established for this purpose. A newsletter was developed which summarized the contents of the EIS; four issues were prepared, each mailed to over 700 people. Public meetings and "Open Houses" served to reach a wider public. Two public meetings were held (one meeting in East Boston and one in Boston) in April 1982, where formal presentations on the project and its potential impacts were made. The "Open Houses" were held in East Boston and South Boston in July 1982. Exhibits of the four build alternatives, existing traffic data, and neighborhood facilities maps were on display; hand-outs on archaeological and historical resources, noise and vibration characteristics and traffic were also available. Advertisements of the public meetings appeared in the local newspapers.

Throughout the study, two project field offices were maintained, one in downtown Boston and another in East Boston. At the field offices, plans of the four build alternatives were on display. The public was encouraged to come view the plans and discuss the proposed project. Display advertisements were placed in local newspapers announcing the field offices and hours of operation.

As requested, the participation staff mailed information relevant to the project. This information included the scope of work of the study, plans of the alternatives, minutes of meetings, handouts distributed at meetings and newspaper articles.

A more detailed description of public participation during the draft EIS/EIR preparation is contained in Appendix 2.

Scoping Process

As a result of the public scoping meetings held on January 28, 1982, numerous written comments were received and contributed to the establishment of the ultimate scope of this study. Copies of the comments received are contained in Appendix 1: Scoping Process. The comments have been numbered, and a summary description of the comments' content is included in the following table. Also indicated in this table are the specific sections in the DEIS where the responses to these comments are addressed.

SCOPING PROCESS COMMENTS

Comment Source (Date)		Subject	DEIS Section	Comment No.
Mass. Exec. Office Environmental Affairs (3/1/82)	o	Detailed technical appendices, index, format.	Comments & Coordination	1
	o	Coverage of specific impacts, graphics, artists' renderings.	Comments & Coordination	2
	o	Traffic concerns: fundamental traffic controversies, extent of traffic network coverage, controlling intersections, expressway choke-points, P.M. peak hour emphasis, volume/capacity ratios, alternatives, allowance for known development, regional growth, induced growth, specific bottlenecks.	Section 2.7 Section 3.1 Section 4.2	3
	o	Alternatives: no-build plus four build.	Section 2.0	4
	o	Ramp modifications to Central Artery (non-major structural alternatives) for traffic relief.	Section 4.2.9	5
	o	Non-structural (other transportation modes) measures for traffic relief.	Section 4.2.9	6
	o	Relationship to other projects, construction sequencing, long-term compatability, existing structures (specific).	Section 2.7 Section 4.1 Section 4.2 Section 4.15	7
U.S. Dept. Health & Human Services (1/23/82)	o	Air pollution.	Section 4.6	8
	o	Transport of toxic & hazardous chemicals in tunnel.	Section 3.1 Section 4.2	9
	o	Hazards from transmission mains & pipelines in tunnel.	Section 2.7	10
	o	Contingency plans/emergency access for health care, fire, police, emergency in tunnel.	Section 2.7 Sections 2.3-2.6 Section 3.1 Section 4.2	11

Comment Source (Date)		Subject	DEIS Section	Comment No.
League of American Wheelmen (1/28/82)	o	Harbor crossing considerations for bicyclists.	Comments & Coordination	12
U.S. Dept. of Interior Fish & Wildlife Service (2/1/82)	o	Habitat loss, alteration,disturbance.	Section 4.8	13
	o	Wetlands.	Section 4.9	14
	o	Floodplains.	Section 4.10	15
		Handling/disposal of excess excavated material.	Section 4.12	16
		Water quality.	Section 4.8	17
	o	Mitigative measures.	Sections 4.8-4.12	18
		Coordination with Fish & Wildlife Service, re permits.	Comments & Coordination	19
Mass. Aeronautics Commission (2/2/82)	o	Third Harbor Tunnel benefits, re improved access to Boston-Logan International Airport.	Section 4.2	20
	o	Third Harbor Tunnel benefits, re reduced airport impacts and need for additional runway capacity.	Section 4.2	21
	o	Third Harbor Tunnel benefits, re reduced airport traffic shortcutting through East Boston neighborhoods.	Section 4.2	22
Mass. Congressional Delegation: Thomas P. O'Neil, Jr.; Edward J. Markey; Paul E. Tsongas; Edward M. Kennedy, (2/3/82)	o	Problems of Central Artery and connections to I-93 & I-95.	Section 4.2, incl. 4.2.6	23
	o	Project cost.	Sections 2.3-2.6	24
		Increased automobile use.	Section 4.2	25
	o	Adverse impacts on Boston neighborhoods.	Sections 4.3-4.5	26
		Non-tunnel alternatives.	Section 2.1	27
Boston Water & Sewer Commission (2/4/82)	o	Tunnel conflicts with existing BWSC overflows/ sewers along Fort Point Channel.	Section 2.7 Section 4.14	28
	o	Tunnel conflicts with proposed BWSC New Boston Main and East Side Interceptors.	Section 2.7 Section 4.14	29

SCOPING PROCESS COMMENTS (Cont'd.)

Comment Source (Date)		Subject	DEIS Section	Comment No.
Boston Water & Sewer Commission (2/4/82) (Cont'd.)	o	Tunnel conflicts with proposed MDC Fort Point Channel CSO Facility.	Section 2.7	30
	o	Fort Point Channel open space and recreation impacts.	Section 4.5 Section 5.1	31
Sierra Club, New England Chapter (2/8/82)	o	Depression of Central Artery as an alternative.	Section 2.1	32
	o	Fort Point Channel Waterfront development impacts.	Section 4.4	33
	o	Other Fort Point Channel alignment alternatives.	Section 2.7	34
	o	Conceptual renderings in EIS.	Comments & Coordination	35
	o	Definition of impact area.	Comments & Coordination	36
	o	Fort Point Channel open space and pedestrian conflicts.	Section 4.4 Section 4.15	37
	o	Impact on historic resources.	Section 4.13 Section 5.3	38
	o	Dredging and disposal of dredge spoils.	Section 4.12	39
	o	Mitigation measures for surface runoff pollution.	Section 4.8	40
	o	Location of "Foul Area".	Section 4.12	41
	o	Visual impacts, tunnel and vents.	Section 4.15	42
	o	Conflicts with <u>Boston Harbor Plan</u> and BWSC sewer interceptor.	Section 2.7 Section 4.4 Section 4.14	43
Association for Public Transportation, Inc. (2/10/82)	o	Tunnel impacts on MBTA system: ridership, revenues, cost increases to communities.	Comments & Coordination	44
	o	Community participation process: role relationship of each committee, membership of Working Committee, decision-making process, veto power of Working Committee participants.	Comments & Coordination	45
		Transit and Central Artery improvement alternatives.	Section 2.1 Section 4.2.6	46

SCOPING PROCESS COMMENTS (Cont'd.)

Comment Source (Date)		Subject	DEIS Section	Comment No.
E.W. Farnum, Resident, Harbor Towers (2/10/82)	o	Depression of Central Artery as an alternative.	Section 2.1	47
	o	Blue Line extension as an alternative.	Section 4.2.9	48
	o	One way tolls.	Section 4.2.9	49
	o	Quality of Life Impacts.	Section 4.0	50
Boston Conservation Commission (2/11/82)	o	Acreage of floodplain affected.	Section 4.10	51
	o	Fort Point Channel & Boston Harbor water areas as recreational resources.	Section 4.4 Section 4.5	52
	o	Tunnel fill requirements and physical/chemical characterstics in water areas.	Sections 4.8-4.9	53
	o	Boston Harbor shellfish bed harvest potential.	Section 4.11	54
	o	Boston Conservation Commission dredging moratorium in Boston Harbor.	Section 2.7 Section 4.12	55
	o	Compatibility with other proposed projects (specfic).	Section 2.7 Section 4.4 Section 4.15	56
	o	Other non-highway alternatives--transit, alternative routes, Logan Airport special routes, one-way tolls.	Section 2.1 Section 4.2.9	57
U.S. Coast Guard (2/12/82)	o	Dredging effects on main Boston Harbor shipping channel.	Sections 2.7	58
	o	Effects of new Fort Point Channel bulkhead line on Coast Guard's newly designated Special Anchorage Area.	Sections 2.3-2.6	59
	o	Effects of construction on normal navigation, including potential channel closures.	Section 2.7, 4.1	60

Comment Source (Date)		Subject	DEIS Section	Comment No.
The Boston Society of Architects (2/12/82)	o	Boston Society of Architects representative on Working Committee.	Comments & Coordination	61
	o	Improvements or Maintenance of Central Artery.	Section 4.2.9	62
Bay State-Spray & Provincetown Steamship Co. (2/13/82)	o	Feasibility of Boston Harbor ferry system.	Comments & Coordination Section 4.2.9	63
Mass. Office of Coastal Zone Management (2/15/82)	o	Flora & fauna lost through construction; impact on marine productivity.	Section 4.11 (Aquatic Vegetation effects)	64
	o	Impacts of fill, including amount, placement, chemical/physical characteristics on marine habitat, water circulation, tidal prism, Coastal Wetland Regulations.	Sections 4.8-4.9	65
	o	Hazardous construction materials and marine impacts.	Section 4.1 Section 4.12	66
	o	Dredging: bulk sediment, grain sizing, bioassay-bioacummulation testing; MCZM inputs into sampling design; restrictive dredging schedule, re fish migration patterns.	Section 4.12 Comments & Coordination	67
	o	Dredging effects on Boston Harbor shipping channel.	Section 4.1 Section 4.12	68
	o	Dredging effects on Red Line Tunnel, Roxbury conduit, East Side Interceptor, MDC CSO	Section 2.7	69
	o	Compatability with proposed Massport Bird Island Flats development.	Section 4.4	70

Comment Source (Date)		Subject	DEIS Section	Comment No.
Mass. Office of Coastal Zone Management (2/15/82) (cont'd)	o	Compatability with proposed BRA/Massport East Boston Piers development including access.	Section 4.4	71
	o	Other non-tunnel alternatives, including transit, water transportation, Central Artery ramps, East Boston roadways.	Comments & Coordination Section 4.2.9	72
	o	Document preferability of build alternatives.	Section 4.0 Section 5.0	73
		Traffic: ADT's, P.M. peak hour inclusion; analysis at critical roadway locations (specific).	Section 3.1 Section 4.2	74
	o	Public access to water's edge; specific public access plans.	Section 4.4 Section 4.5 Section 5.1	75
		MCZM receipt of Interagency Committee meeting materials.	Comments & Coordination	76
U.S. Environmental Protection Agency (2/16/82)	o	Air quality-identification of roadway network/impact area.	Section 3.1 Section 3.4	77
	o	Air quality-identification of monitoring sites.	Section 3.4	78
	o	Evaluation of sixth, "upgrade of existing roadways" alternative.	Comments & Coordination Section 4.2.9	79
	o	Violations of National Ambient Air Quality standards: mitigative measures, including one-way tolls.	Section 4.2.9 Section 4.6	80
	o	Dredge & Fill aspects Section 404 of Clean Water Act.	Sections 4.8-4.9 Section 4.12 Comments & Coordination	81
	o	Effects on EPA funded projects (specific).	Section 2.7	82
Metropolitan Area Planning Council (2/16/82)	o	Traffic analysis should include impacts on other major highway facilities including	Section 3.1 Section 4.2	83

Comment Source (Date)		Subject	DEIS Section	Comment No.
Metropolitan Area Planning Council (2/16/82) (cont'd)		Central Artery, Mass Turnpike, Storrow Drive, Mystic-Tobin Bridge.		
	o	Include most recent highway development plans in analysis, including Leverett Circle Connector, Central Artery improvements.	Section 4.2	84
	o	Potential land use impacts -- Boston/East Boston.	Section 4.3-4.5	85
	o	Fort Point Channel development impacts, including ventilation towers, relocating streets, reduced channel width.	Section 2.7 Section 4.2 Section 4.4 Section 4.15	86
	o	Fort Point Channel historic/National Register impacts.	Section 3.10 Section 4.13 Section 5.3	87
	o	East Boston residential neighborhood impacts: relocations? vent towers?	Section 2.7 Section 4.3 Section 4.4 Section 4.15	88
Boston Redevelopment Authority (2/10/82)	o	Impacts on Bird Island Flats development.	Section 4.4	89
	o	Impacts on Fort Point Channel development and historic character, incl. Rowes Wharf.	Section 4.4 Section 4.13 Section 5.3	90
	o	Impacts on South Station Transportation Center.	Section 4.4 Section 4.2	91
	o	Impacts on Boston Pier 1 and Pier 4.	Section 4.4	92
	o	Impacts on East Boston Piers 1 to 5.	Section 4.4	93
	o	Impacts on Fort Point Channel CSO/sewer improvements.	Section 2.7	94
	o	Impacts on MBTA Red Line.	Section 2.7	95
	o	Increased ground access effect on Logan Airport development.	Section 4.4	96
		Air quality-benefits, hot spots, modelling of worst case conditions.	Section 3.4 and 4.6	97
	o	No Build Alternative traffic includes planned roadway developments,	Section 2.2 Section 4.2 Section 4.2.9	98

Comment Source (Date)		Subject	DEIS Section	Comment No.
Boston Redevelopment Authority (2/10/82) (cont'd)		improved toll collection, transit improvements, etc.		
	o	Impact of seismic activity on tunnel; tunnel impacts on existing Red Line tunnel.	Section 2.7 Sections 2.3-2.6 Section 4.7 Comments & Coordination	99
	o	Boston Harbor and Fort Point Channel fill impacts and quantity.	Sections 2.3-2.6 Sections 4.8-4.9 Section 4.10	100
	o	Community disruption.	Section 4.4, 4.5	101
	o	Aesthetics, visual impacts, re vent shafts.	Section 4.15, 4.2	102
	o	Mitigation measures.	Section 4.0	103
	o	Alternatives--public transit.	Section 2.1 Section 4.2.9	104
	o	Alternatives--toll booth locations.	Section 2.7	105
City of Revere Office of Planning and Community Development (1/28/82)	o	Impacts on City of Revere, re traffic and accident effects on Route 1, Bell Circle, Beachmont Square; auto insurance rate increases.	Section 4.2 & 4.4 Comments & Coordination	106
	o	Land takings for improvements/expansion of Revere traffic arteries due to increased traffic.	Section 4.2 Sections 2.3-2.6	107
American Lung Association (2/18/82)	o	Air quality impacts--local vs. regional.	Section 3.4 Section 4.6	108
	o	Traffic impacts--extent of traffic impact area; local streets plus major roadways.	Section 3.1 Section 4.2	109
	o	Traffic flow improvement/vehicle miles travelled vs. air quality impacts.	Section 4.2 Section 4.6	110
	o	Tunnel impacts on Blue Line, mass transit improvement funding.	Comments & Coordination	111
	o	Air quality impacts, re ability to meet State Implementation Plan.	Section 4.6	112

Comment Source (Date)		Subject	DEIS Section	Comment No.
Mass. Department of Environmental Quality Engineering, Air Quality Control Section (2/22/82)	o	Determine appropriate air quality modelling techniques, assumptions, variables through consultation with DEQE.	Section 3.4 Section 4.6 Comments & Coordination	113
	o	Air quality analysis should include all roadway links affected by project, and extend to Bell Circle.	Section 3.4 Section 4.6	114
	o	Vent tower locations vs. CO and NO_x impacts; dispersion modeling.	Section 4.6	115
	o	Sensitive recepter determination through FHWA, MDPW, EOEA, DEQE consultation.	Section 3.4 Section 4.6 Comments & Coordination	116
	o	Achievement of worst case conditions, re NCHRP 200 and consultation if not, reuse of historical/other data.	Section 3.4 Comments & Coordination	117
	o	Mitigative measures, including alternative toll measures, if project not consistent with Mass. SIP.	Section 4.6	118
U.S. Army, New England Division, Corps of Engineers (2/26/82)	o	Request to FHWA that Corps function as cooperating agency.	Comments & Coordination	119
	o	Core sampling in Boston Harbor, scheduling/coordinating with Coast Guard.	Comments & Coordination	120
	o	Navigational clearances coordination with Army Corps and Coast Guard.	Comments & Coordination	121
	o	Navigational clearances within main ship channel, re channel improvements.	Section 2.7	122
	o	Federal projects scheduled for Boston Harbor area.	Section 2.7	123

Comment Source (Date)	Subject	DEIS Section	Comment No.
League of Women Voters of Boston (3/1/82)	o Additional alternatives-depression and widening of Central Artery.	Section 2.1	124
	o Additional alternatives modifications to Central Artery.	Section 2.1 Section 4.2.9	125
	o Additional alternatives-alternative toll strategies.	Section 4.2.9	126
	o Additional alternatives transit options.	Section 2.1 Section 4.2.9 Comments & Coordination	127
	o Community Participation	Comments & Coordination	128

As indicated in the previous table, a number of these responses are contained within this COMMENTS AND COORDINATION section. These particular responses follow.

Comment No. 1. The text of the DEIS/DEIR has been written in a layperson's terms, and has been supplemented with graphical material to clarify the various topics. Detailed technical documentation of the various subject area (e.g., traffic, air quality, noise, etc.) data collection efforts, analysis procedures, and assumptions and interpretations are contained in Technical Appendices and Supplemental Reports, which are separate volumes to the DEIS/DEIR document. Also, included in the SUMMARY of this document is a chart intended to allow the reader a straight-forward comparison of the alternatives. The reader is asked to consult the DEIS/DEIR's Table of Contents, List of Figures, List of Tables, List of Technical Reports, List of Supplemental Reports and Index for assistance in locating specific areas of project and environmental impact interest.

Comment No. 2. All areas of potential impact identified at the scoping sessions as being relevant to this project in the Executive Office of Environmental Affairs (EOEA's) scoping reply of March 1, 1982 are addressed in the DEIS/DEIR. The reader is asked to consult the Table of Contents, which summarizes these areas of impact, and their locations in the DEIS/DEIR. Graphic descriptions, including axonometrics, have been used to illustrate discussions of visual impacts.

Comment No. 12. Four options for a bicyclist harbor crossing were suggested by the League of American Wheelmen. The first, which they indicate is the least favorable from their standpoint, is an enclosed lane in one of the existing tunnels or in the new third tunnel. A bicycle lane within the Third Harbor Tunnel is not part of the project. Furthermore, exposure to vehicle exhaust emissions would necessitate a separate tunnel chamber with appropriate intake (fresh air) and exhaust ventilation separate from the vehicle tunnels. This bicycle tube concept would add approximately $30 to 50 million to the project costs alone, in addition to approach costs. Addition of an enclosed lane to the existing tunnels, plus the other three suggested options, a harbor ferry for pedestrians and bicyclists, a bike van service, and bicycle access to the MBTA Blue Line, are all options which are compatible with the tunnel project. Implementation of these options, however, would require alternative funding sources.

Comment No. 19. Coordination with the Fish and Wildlife Service was accomplished through their membership on the Interagency Committee (discussed previously) and at an additional meeting on September 3, 1982. At that meeting, concern was expressed over the alterations to the Lynn Harbor Fabrication Site and the effects on marine life. These effects are discussed in Section 4.17. Updates of the various engineering features of the alternatives, results of chemical analyses of dredge material, information regarding the proposed tunnel fabrication site, etc. were presented at this meeting.

Comment No. 36. The study impact area, as well as the project area, was defined following the results of the Scoping Process.

Comment No. 44. The evaluation of the impact of the new tunnel on MBTA systemwide revenues and costs to local communities is outside the scope of this DEIS/DEIR.

Comment No. 45. The specific composition and responsibilities of the citizens' Working Committee, as well as all other aspects of this projects' community participation process, have been summarized earlier in this section and are detailed further in Appendix 2: Public Participation Process. The Working

Committee functions in an advisory capacity only; it does not possess decision-making or veto powers.

Comment No. 61. Boston Society of Architects participation, as well as participation by any and all interested citizens and groups, has been welcomed at Working Committee meetings. The Boston Society of Architects in fact has participated regularly in Working Committee meetings.

Comment No. 63. The performance of a feasibility study related to restoration of a passenger-vehicle ferry system in Boston Harbor is outside the scope of this DEIS/DEIR. However, cross-harbor ferry service to Logan Airport was one of 11 transit options considered in the 1980 Corridor Planning Study for this project. At that time, it was concluded that the demand for cross harbor transportation service could not be adequately met by transit improvements alone. All are, however, considered to be feasible complementary projects to the No-Build and four build alternatives evaluated in this DEIS/DEIR. Towards that end, Section 4.2.9, Consequences of Other Transportation Improvements, analyzes the year 2010 traffic implications of cross-harbor ferry services.

Comment No. 67. The Massachusetts Office of Coastal Zone Management (MCZM) has provided input into the sampling design for the bioassay-bioaccumulation tests. A meeting was held on June 29, 1982, with MCZM, the US Army Corps of Engineers, and the US Environmental Protection Agency to discuss the sampling design and necessary analyses. Although the Massachusetts Division of Water Pollution Control could not attend the June 29 meeting, they were represented by MCZM.

Comment No. 72. Several of the non-tunnel options mentioned by MCZM were studied in the Corridor Planning Study. As indicated in the response to Comment No. 63, it was concluded that such options were not viable alternatives to the Third Harbor Tunnel because they could not accommodate the harbor crossing demands. However, since they are projects which could complement the No-Build or tunnel build alternatives evaluated in this DEIS/DEIR, a special study of the traffic implications of several of these alternatives was performed, and is contained in Section 4.2.9, Consequences of Other Transportation Improvements.

Comment No. 76. Progress on the study was presented to the Interagency Committee in detailed written form on a monthly basis. At these meetings, plans, profiles and sections were displayed and explained in detail. Additional meetings were held with Massachusetts Coastal Zone Management staff during the study to discuss various testing procedures for harbor sediments, and expected project impacts.

Comment No. 79. The FHWA, in a letter to EPA dated March 24, 1982, indicated that the option to upgrade the existing highway facilities had been evaluated in the Corridor Planning Study and was eliminated from consideration in the Environmental Impact Statement. However, analysis of non-major structural modifications to the Central Artery, and its approaches (ramps, intersections, connecting streets, etc.) to the existing Sumner and Callahan Tunnels, and transit system improvements (Blue Line, cross-harbor ferry, bus/limousine) were conducted as a special study, and are summarized in Section 4.2.9, Consequences of Other Transportation Improvements. (Also response to Comment No. 5 by EOEA).

Comment No. 81. Although all of the necessary data to perform a Section 404 evaluation has been gathered, the actual permit application has not been prepared.

Comment No. 99. The impacts of seismic activity on the tunnel were evaluated, and are contained in the supplemental Supportive Engineering Report. This report concluded that

the tunnel's integrity would not be affected by seismic activity in the area.

The impacts of the Third Harbor Tunnel on the Red Line structure were also evaluated, and are summarized in Section 2.7, Design Considerations and Section 4.7, Noise and Vibration. Details of these evaluations are contained in Appendix 6: Noise and Vibration, and the supplemental Supportive Engineering Report.

Comment No. 106. The traffic and air quality impacts of the proposed project on Route 1A in Revere, and specifically at Bell Circle are contained in Section 4.2, Transportation and Section 4.6, Air Quality, respectively. Accident effects are also evaluated in Section 4.2 for Bell Circle. Estimation of impacts on auto insurance rates for Revere residents is outside the scope of this study.

Comment No. 111. Estimation of the physical impact of this project on the Blue Line is contained in several sections of this report, including the alternative descriptions in Sections 2.3 through 2.6; Section 2.7, Design Considerations; and Section 4.2, Transportation. Estimation of the tunnel's impact on possible funding for mass transit improvements is outside the scope of this study.

Comment Nos. 113, 116, and 117. The U.S. EPA and Massachusetts DEQE were consulted throughout the study in determining air quality modeling techniques, assumptions, sensitive receptor locations and carbon monoxide background concentrations. For additional details, see Sections 3.4 and 4.6 of the DEIS re.: Air Quality, and Appendix 5.

Comment No. 119. On March 9, 1982, the FHWA acknowledged the request of the Corps of Engineers to be a cooperating agency on the Third Harbor Tunnel project.

Comment No. 120. Scheduling of core sampling was coordinated with the U.S. Coast Guard through two early meetings and daily telephone contact throughout the drilling phase.

Comment No. 121. Both the U.S. Coast Guard and the Corps of Engineers were contacted relative to the navigational clearances within and beyond the Federal channel limits. The tunnel profiles have been adjusted to accommodate future deepening of the main shipping channel in Boston Harbor by the Corps of Engineers. The Coast Guard has not commented on the proposed construction activities in Boston Harbor.

Comment No. 127. See also responses to Comments Nos. 63 and 72. Cross-harbor transit options were rejected in the Corridor Planning Study as viable options, of themselves, to a Third Harbor Tunnel (see Section 2.1, Alternatives Selection Process). However, they have been evaluated in the DEIS/DEIR as complementary projects to either the No-Build or tunnel build alternatives, and are discussed in Section 4.2.9, Consequences of Other Transportation Improvements.

Comment No. 128. A summary of the community participation process conducted during preparation of the DEIS/DEIR was presented earlier in this section. More detail is presented in Appendix 2: Public Participation Process.

The following section briefly describes the responsibilities and qualifications of some of the individuals who have been involved in the preparation of the Draft Environmental Impact Statement/ Environmental Impact Report for the Third Harbor Tunnel study.

Frank A. Bracaglia

Staff Specialist for Environment, Federal Highway Administration (FHWA)

Mr. Bracaglia is a civil engineer and environmental specialist with more than seven years of experience with FHWA. He has worked on portions or supervised the preparation of numerous highway environmental documents. Mr. Bracaglia was the FHWA representative to the Project Committee and was responsible for the document's conformancy with Federal requirements. He was also extensively involved in the Federal review and coordination of the draft document. He holds a Bachelor of Science degree in civil engineering.

J. William Oliver, P.E.

Supervisor, Central Artery Section, Massachusetts Department of Public Works (MDPW)

Mr. Oliver has 32 years of experience in highway planning and design. He represented MDPW on the Project Committee and was responsible for supervision, review, and coordination of the draft document for MPDW.

M. C. Crain, P.E.

Chief Engineer, Massachusetts Turnpike Authority

Mr. Crain, Chief Engineer with the Turnpike Authority, has 32 years of experience in highway, bridge, and tunnel design and construction management. Mr. Crain represented the Turnpike at Project Committee and public meetings for the Third Harbor Tunnel environmental study. He holds a Bachelor of Science degree in civil engineering.

William J. Rizzo

Assistant Secretary, Executive Office of Transportation and Construction (EOTC)

Mr. Rizzo is a certified planner with 13 years of experience, including experience as a Municipal Planning Director and as a consultant in engineering, planning, and environmental issues. In this study, Mr. Rizzo represented EOTC on the Project Committee overseeing the direction of the tunnel study. Mr. Rizzo has Masters degrees in both civil engineering and city planning.

Vincent Losinno

Assistant Secretary and General Counsel, Executive Office of Transportation and Construction (EOTC)

Mr. Losinno is a practicing attorney with 10 years of experience, specializing in transportation and Federal law. He has worked extensively with a number of Federal agencies including the Federal Highway Administration and U.S. Department of Transportation. As an EOTC representative to the current study's Project Committee, Mr. Losinno has been involved in the overall direction of the tunnel project.

John L. Gardner, P.E.

Supervising Civil Engineer, Massachusetts Department of Public Works (MDPW)

Mr. Gardner is a transportation and highway design engineer with 32 years of experience at MDPW. He holds a degree in civil engineering. In the

Third Harbor Tunnel study, Mr. Gardner assisted in the review and critique of the draft document. He also supervised the project's engineering submissions to the Department of Public Works.

Norman C. Letourneau

Senior Civil Engineer, Massachusetts Turnpike Authority (MTA)

Mr. Letourneau is the MTA's representative to the Third Harbor Tunnel study's Project Committee. He has 15 years of experience in the design and construction of highways and bridges, and has been involved in several environmental impact studies. As a member of the Project Committee, Mr. Letourneau helped to oversee the general direction of the current study and contributed to the review of the draft document. He holds a degree in civil engineering.

Robert M. Horigan, P.E.

Environmental Engineer, Massachusetts Department of Public Works (MDPW)

Mr. Horigan heads the MDPW's Environmental Section. Mr. Horigan has prepared and supervised many environmental documents during the past ten years. For this study, he was involved in the review of the draft document at the State level.

James Allen, P.E.

Supervising Transportation Planning Engineer, Massachusetts Department of Public Works (MDPW)

Mr. Allen has 33 years of experience in highway engineering and transportation planning and has directed numerous transportation projects for the MDPW involving traffic analysis and traffic forecasting. He holds a Masters degree. In this study, Mr. Allen supervised the Central Transportation Planning Staff's efforts in transportation forecasting.

Gordon H. Slaney, P.E.

Project Manager, HFMW - A Joint Venture

Mr. Slaney is a civil engineer and an Associate with Howard Needles Tammen & Bergendoff. He has 16 years of project management, administration, and design experience in environmental and highway projects including planning, environmental impact analysis, preliminary and final designs, and construction. As Project Manager of the current study, Mr. Slaney had overall responsibility for project budgeting, administration, and coordination; and was also responsible for the technical quality and content of the environmental document. Mr. Slaney holds a Masters degree in civil engineering.

Rodney P. Plourde, P.E., Ph.D.

Deputy Project Manager - Environmental, HFMW - A Joint Venture

An Associate and Vice President with Fay, Spofford & Thorndike, Inc., Mr. Plourde has 14 years of experience in the field of transportation planning and engineering, and has worked on more than 25 impact statements. He holds a doctorate degree in transportation with a minor in city planning. In this study, Mr. Plourde was responsible for the overall content and production of the environmental document and related reports.

Leonard J. Barbieri, P.E.

Deputy Project Manager - Engineering, HFMW - A Joint Venture

Mr. Barbieri has 26 years of experience evaluating and designing large-scale transportation engineering projects. A senior engineer with CE Maguire, Inc., Mr. Barbieri holds a Bachelor of Science degree in industrial technology. As Deputy Project Manager for Engineering, Mr. Barbieri was responsible for directing and coordinating all engineering aspects related to the Third Harbor Tunnel study, including preparation of

engineering-related portions of the environmental document.

Adel Foz

Deputy Project Manager - Planning/ Urban Design, HFMW - A Joint Venture

Mr. Foz, an Associate with Wallace, Floyd, Associates Inc., has extensive experience in highway-related impact studies, regional impact studies, and urban design and neighborhood planning. Mr. Foz holds advanced degrees in architecture, urban design, and planning. His responsibilities in the present study included coordination of the planning and urban design efforts with traffic and engineering disciplines, and supervision of preparation of land use, community facilities and visual portions of the environmental document.

Lydia E. Mercado

Deputy Project Manager - Community Participation, HFMW - A Joint Venture

Ms. Mercado, a planner with Wallace, Floyd, Associates Inc., has extensive experience in designing and implementing community participation programs, including programs for several major transportation projects. Ms. Mercado holds a Masters degree in city and regional planning. In the present study, she was responsible for overall coordination of the community participation efforts.

Carl V. Anderson, Jr., P.E.

Deputy Project Manager - Administration, HFMW - A Joint Venture

Mr. Anderson is a civil engineer with Howard Needles Tammen and Bergendoff with approximately 30 years of engineering design and project management/administration experience. He holds a Bachelor of Science degree in civil engineering. For the present study, Mr. Anderson was responsible for financial and contractual administration of the joint venture and its subconsultants.

Robert W. Kelly, P.E.

Deputy Project Manager - Agency Liaison, HFMW - A Joint Venture

Mr. Kelly, a senior engineer with Fay, Spofford & Thorndike, Inc., has 13 years of experience in the design of major interstate highways. He holds a Bachelor degree in engineering technology. In the present study, Mr. Kelly was responsible for coordination and dissemination of project information to the Interagency Committee on a monthly basis and for responding to the concerns of other agencies and private industry about the study.

Dean L. Groves

Environmental Document Coordinator, HFMW - A Joint Venture

Mr. Groves has eight years of experience in the evaluation of environmental impacts of public works and private industry projects. A senior engineer with Fay, Spofford & Thorndike, Inc., Mr. Groves has been extensively involved in several environmental impact statements and reports for major transportation and development projects in Massachusetts and more than twenty environmental assessments for wastewater improvement projects. He holds a Bachelor of Science degree in civil engineering. In the present study, Mr. Groves assisted in the overall review and production of the environmental impact statement/report.

Edward L. Mahoney, P.E.

Engineering Coordinator, HFMW - A Joint Venture

Mr. Mahoney, a civil engineer specializing in highway drainage, erosion, and sedimentation control at CE Maguire, Inc., has over ten years of experience in highway engineering and environmental analysis. He holds a Masters degree in civil engineering. In the present environmental study, Mr. Mahoney was involved in

highway, structural, and drainage engineering; utilities; and engineering tasks; and contributed to supportive engineering and energy portions of the environmental document.

James Purdy

Planning and Urban Design Coordinator, HFMW - A Joint Venture

A senior planner with Wallace, Floyd, Associates Inc., Mr. Purdy has extensive experience in environmental policy, land use, and transportation related studies. Mr. Purdy holds a Masters degree in city planning. His areas of responsibility in the present study included assisting in the coordination of the planning and urban design efforts, evaluation of the historical and open space impact assessments, and preparation of those portions of the environmental document.

H. H. Smallridge

Urban Designer, HFMW - A Joint Venture

A senior urban designer with Wallace, Floyd, Associates Inc., Mr. Smallridge has 12 years of urban design experience. Mr. Smallridge is an adjunct professor in the City Planning program at Boston University, and has lectured on design at several local universities. He holds a Bachelor of Architecture degree and has completed numerous graduate level courses in architecture and urban design. In the present study, Mr. Smallridge was responsible for assessing the visual and physical impacts of the project and developing urban design mitigating measures for these impacts. He also contributed to the visual and urban design/joint development portions of the environmental document.

Mary M. Konsoulis

Community Participation Coordinator, HFMW - A Joint Venture

Ms. Konsoulis, a planner with Wallace, Floyd, Associates Inc., was involved in the community participation and planning effort in the present study, was editor of the study's newsletter, and assisted in editing portions of the environmental document. Ms. Konsoulis has participated in planning studies focusing on industrial relocation and waterfront rehabilitation. She holds a Masters degree in city and regional planning.

John C. Yaney, P.E.

Transportation Planner, HFMW - A Joint Venture

Mr. Yaney, a senior engineer with Fay, Spofford & Thorndike, Inc., has ten years of experience in transportation planning and traffic impact analysis. He has been involved in a number of environmental impact studies, airport master plans, and highway location studies. Mr. Yaney holds a Masters degree in civil engineering and transportation. In the current study Mr. Yaney was involved in traffic data collection and analysis, coordinated traffic projections for the five tunnel alternatives with the Central Transportation Planning Staff and the Massachusetts Department of Public Works, and assisted in the preparation of the transportation portions of the documents.

Joseph G. Grilli

Traffic Engineer, HFMW - A Joint Venture

Mr. Grilli is an associate transportation engineer with Howard Needles Tammen & Bergendoff. Mr. Grilli's areas of specialization include traffic forecasting, analysis, and traffic engineering design. He holds a Bachelor of Science degree in civil engineering. In the present study, Mr. Grilli was involved in traffic data collection and impact analysis, and contributed to transportation portions of the environmental document.

Thomas E. Lisco, Ph.D.

Central Transportation Planning Staff (CTPS) - Traffic Forecasts

Mr. Lisco is a systems planning manager at CTPS. He has 14 years of experience in travel analysis demand and transportation project evaluation, and holds a doctorate degree in economics. In this study, Mr. Lisco was responsible for CTPS' development of traffic forecasts for the five alternatives.

Wendy Landman

Planner, HFMW - A Joint Venture

Ms. Landman is a planner with Wallace, Floyd, Associates Inc. and has experience in transportation planning, urban design, and community development. Ms. Landman holds a Masters degree in city planning. Ms. Landman participated in preparation of both the sections on land use and community facilities impacts, and the production of graphics for the environmental document.

Ruth Kolodney

Planner, HFMW - A Joint Venture

Ms. Kolodney, a planner with Fay, Spofford & Thorndike, Inc., has experience in land use planning, relocation issues, and community development and participation. She holds a Masters degree in city planning. For the present study, Ms. Kolodney conducted interviews with businesses and property owners affected by the project, prepared the Conceptual Relocation Plan Report, and assisted in the editing and production of the environmental document.

Carole Schlessinger

Planner, HFMW - A Joint Venutre

A planner with Wallace, Floyd, Associates Inc., Ms. Schlessinger has experience in planning, community participation, and impact evaluation of various public and private projects. Ms. Schlessinger holds a Masters degree in community and regional planning. In the present study, she performed the Section 4(f) Evaluation and was involved in general planning and community participation elements of the study.

K. Meng Chng

Bolt Beranek & Newman Inc. - Air Quality Assessment

Mr. Chng has 16 years of experience in performing air quality analyses of various transportation and private industry projects, and has participated in more than two dozen environmental impact studies. He holds a Bachelor of Science degree in earth sciences. In the current study, Mr. Chng was responsible for preparation of the air quality analysis of the proposed project including documentation of existing conditions and modelling the future air quality characteristics of the area.

David A. Towers, P.E.

Bolt Beranek & Newman Inc. - Noise and Vibration Assessment

Mr. Towers is an acoustical engineer with more than eight years of experience. He has been involved in environmental assessments for noise and vibration control, community noise evaluation and assessment, and noise and vibration control for surface transportation systems. Mr. Towers holds advanced degrees in mechanical engineering and acoustics. For the current study, Mr. Towers supervised noise and vibration tasks which involved data collection and analysis, evaluation of impacts, and preparation of those portions of the documents.

Carlton Noyes

Jason M. Cortell and Associates Inc. (JMCA) - Water Resources

Mr. Noyes, Director of the Water Quality Group at Jason M. Cortell and Associates Inc., has 15 years of experience in environmental

consulting, principally in preparation of environmental impact statements, feasibility studies, and site plan documents. Mr. Noyes holds a Masters degree in zoology. In the present study, Mr. Noyes was project manager for JMCA, responsible for documenting existing conditions and evaluating impacts on water resources, wetlands, vegetation and wildlife, and Harbor sediment characteristics.

John Dugan

Haley & Aldrich, Inc. (H&A) - Geotechnical Studies

A practicing geotechnical engineer for 14 years, Mr. Dugan has been involved in a variety of major projects which include tunnel, highway, and building subsurface engineering. Mr. Dugan holds a Masters degree in civil engineering. In the current study, Mr. Dugan was responsible for investigation of subsurface conditions, tunnel foundation design, and support systems for structures near the proposed tunnel alignments.

Richard A. Siegel, Ph.D.

Economics Research Associates, Inc. (ERA) - Economic Assessment

Dr. Siegel, a principal with ERA, is a specialist in the economics of land development. Dr. Siegel has 20 years of experience in research and consulting and has authored more than 20 publications on regional economics and land development. He holds a doctorate degree in business administration and economics. In the current study, Dr. Siegel supervised ERA's economic inventory and impact analysis.

Victor Impemba

Bryant Associates, Inc. - Right-of-Way Investigation

Mr. Impemba is a civil engineer with 14 years of experience working on a variety of projects involving highway and transit design, property investigation, and preparation of construction specifications and estimates. In the present study, Mr. Impemba was involved in property research and preparation of right-of-way plans for the various alternatives.

Pauline C. Harrell

Boston Affiliates, Inc. - Historical Resources

Ms. Harrell, Vice President of Boston Affiliates, Inc., is a social and architectural historian with 12 years of teaching and consulting experience. She holds a Masters degree in history and is on the faculty at Boston University in the graduate program for preservation studies. Ms. Harrell supervised the historical resources inventory and impact assessment in the Third Harbor Tunnel study.

Russell J. Barber, Ph.D.

Institute of Conservation Archaeology (ICA) - Archaeological Resources

As Director of ICA, Dr. Barber was responsible for the overall review, research, and documentation for the Phase I archaeological investigation for the Third Harbor Tunnel study. Dr. Barber holds a doctorate in archaeology. He has specialized in New England archaeology since 1971, and has published 20 articles and two books on the subject.

Neil Farmer

Ryan, Elliott Appraisal and Consulting Company, Inc. - Conceptual Appraisal and Real Estate Analysis

Mr. Farmer, Vice President of Ryan, Elliott Appraisal and Consulting Co. Inc., has ten years of experience in real estate consulting and appraisal. He has worked with a wide variety of public and private clients throughout New England. For the tunnel study, Mr. Farmer supervised the firm's estimates of probable acquisition costs for various properties, estimated relocation resources, and helped to identify the availability of relocation space.

Charles R. Norris

Stull Associates - Urban Design

Mr. Norris, a senior associate with Stull Associates, has 13 years of experience as an architect and urban designer. His experience has focused on large-scale architectural projects, transportation projects, and master planning. Mr. Norris holds Masters degrees in architecture and urban design. In the tunnel study, Mr. Norris supervised Stull Associates' assistance to the joint venture in urban context analysis, impact analysis, and base map preparation.

Otto Bojesen

Christiani; and Nielsen, Corp. - Tunnel Construction

Mr. Bojesen is a civil engineer with over 33 years of experience in bridge and tunnel design; he has been chief engineer with Christiani and Nielsen since 1961, and holds a Masters degree in civil engineering. In this project, Mr. Bojesen supervised the production of the critique on concrete sunken tube tunnel construction for the Supportive Engineering phase of the study.

Morse H. Klubock, P.E.

Perini Corporation - Tunnel Construction

Mr. Klubock, manager of the Marine Division of Perini Corporation, is a civil engineer with nearly 30 years of experience. He is in overall charge of the Corporation's marine and heavy foundation construction operations and manager of design. He holds a Bachelor of Science degree in civil engineering. For the tunnel study, Mr. Klubock supervised the engineering critique on the feasibility of steel sunken tube construction for the Supportive Engineering phase of the study.

INDEX

BIBLIOGRAPHY

The below-referenced documents constitute the major past reports dealing with the Third Harbor Tunnel Project and related improvements to the Central Artery. This is a general bibliography only; the reader is asked to refer to the bibliographies contained in the Technical Appendices and Supplemental Reports for subject-specific reference sources (e.g., traffic, air quality, land use, etc.).

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